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REPORT

OF THE

VETERINARY DEPARTMENT

OF THE

MINNESOTA

STATE BOARD OF HEALTH.

AUGUST 1, 1900, TO MAY 1, 1903.

BY

S. D. BRIMHALL, V. M. D.,	Director of the Department.
F. F. WESBROOK, M. D.,	Director of the Laboratory.
H. M. BRACKEN, M. D.,	Secretary and Executive Officer.

ST. PAUL, MINN.:
THE PIONEER PRESS COMPANY.
1903.

Office of the State Board of Health,
St. Paul, Minn., July 31, 1903.

To His Excellency Samuel R. Van Sant, Governor:

The State Board of Health herewith respectfully submits its report upon the veterinary work of the Board from Aug. 1, 1900, to April 22, 1903.

During this period the Veterinary Department of the Board was under the directorship of Dr. S. D. Brimhall. He was ably assisted by Dr. J. G. Annand, field veterinarian.

The Bacteriological Laboratory of the Board, under the directorship of Dr. F. F. Wesbrook, rendered valuable service in the study of animal diseases, as shown throughout the entire report. It is worthy of note that the Bacteriological Laboratory was seldom called upon to join in the study of animal diseases, until Dr. Brimhall became director of the Veterinary Department. Undoubtedly, Dr. Brimhall's experience as field veterinarian, prior to his directorship, emphasized the necessity of collaboration with the laboratory, both in field and experimental work. The economic results of such joint action are shown throughout this report. They are far reaching and of great financial value.

H. M. BRACKEN, M. D.,
Secretary and Executive Officer.

M66
1903

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MRS. M. I. ROGERS	Registering Clerk and Stenographer
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ERRATA.

Page 84, line 25—Wolden should read Walden.
Page 96, line 3—Candota should read Kandota.
Page 129, last line—Add "except in rabbit No. 440."
Page 137, line 1—Lyon should read Redwood.
Page 138, line 18—Mycotic Stomatitis should read "Mycotic Apthous Fever."
Page 139, line 16—Conway of Ohio should read Connaway of Columbia, Mo.
Page 139, line 17—Mycotic Stomatitis should read "Mycotic Apthous Fever."
Page 150, line 7,—Barden township, Carver county, should read Barden, Scott county.
Page 179, lines 10, 11 and 12 should be at bottom of page 195.
Page 194, line 37—Dakota should read Washington.
Page 278, line 34—Colt should read case.
Page 313, line 23—Strongulus should read strongylus.
Page 319, line 19—strongulus should read strongylus.
Page 335, line 31—Mesenteric should read mesentery.
Page 374, lines 16 and 17—No. —, should be omitted.

REPORT
OF THE
VETERINARY DEPARTMENT
OF THE
MINNESOTA
STATE BOARD OF HEALTH.

INTRODUCTION.

This report should appear as covering the period from Aug. 1, 1900, to Aug. 1, 1902, and as a part of the nineteenth report of the State Board of Health and Vital Statistics. The last legislature saw fit to create a new department to care for infectious diseases of animals, under the title of *State Live Stock Sanitary Board.* It has therefore been deemed advisable to make this the final report of the work upon infectious diseases of animals by the Minnesota State Board of Health.

The care of infectious diseases of animals was placed under the State Board of Health in 1885. These as well as infectious diseases of man were under the control of the secretary, Dr. C. N. Hewitt, until 1897, at which time Dr. M. H. Reynolds, a veterinarian, was made a member of the State Board of Health. Infectious diseases of animals were at once placed under his direction: First, as chairman of the committee having charge of infectious diseases of animals, and later as director of the Veterinary Department. The work continued under Dr. Reynolds' care until August, 1900, a period covering a little more than three and one-half years. During this period the Veterinary Department of the Minnesota State Board of Health was located at the Agricultural Experiment Station, St. Anthony Park.

Gov. John Lind took the position that all departments of the State Board of Health should be located at one and the same place. It was therefore decided early in 1900 to move the Veterinary Department of the Board to St. Paul, and this change was made the first of August of that year.

Governor Lind also took the position that it was unwise for a Board to appoint its own members as directors of departments, and in his reappointment of Dr. Reynolds as a member of the Board in 1900, he made it a condition that he should no longer hold the directorship of the Veterinary Department.

After the removal of the Veterinary Department to the offices of the Minnesota State Board of Health, St. Paul, the work was conducted by Dr. S. D. Brimhall, first, as field veterinarian, Dr. Reynolds still holding an advisory position in the work pertaining to this department.

At the regular quarterly meeting of the Board, April, 1901, it was proposed to make Dr. Brimhall director of this department, but there being one dissenting vote no action was taken. At the July meeting of the same year, Dr. Brimhall was made director of the department and continued to hold this position until its demise upon the creation of the State Live Stock Sanitary Board, April 23, 1903. Under his directorship this work was most ably carried on, covering not only the clinical study of infectious diseases of animals and their care, but the laboratory investigation of such diseases in conjuction with Dr. F. F. Wesbrook, director of the Laboratory of the Board. The importance of studying infectious diseases of animals and of man in the same laboratory and under the control of the same board was fully appreciated and the fact was recognized that many of these diseases are transmissible from animal to man, and vice versa.

In addition to his office duties Dr. Brimhall gave much time to visiting outbreaks of animal diseases, either alone or in company with a representative from the Laboratory. The good work resulting from such investigations must be studied under the records of the various diseases covered in this report. In addition to this local work Dr. Brimhall took steps to keep himself posted on possible invasions from other sections of the country, having visited the New England states at the time of the "*foot and mouth disease*" in that section; also having visited neighboring states from time to time in order to learn the extent of danger from glanders, anthrax, etc.

The excellent work of Dr. Annand must not be overlooked in these introductory remarks. His time was fully occupied as field veterinarian in watching hog cholera, especially during the season of its greatest prevalence, and also in looking after glanders, bovine tuberculosis and other animal diseases throughout the state. His manner of dealing with sanitary officials with whom he came in contact, as also with the owners of diseased stock, was most satisfactory.

Mr. W. J. Pomplun acted as sanitary inspector for the Board, in looking after the quarantined cows condemned through the tuberculin test by the local health authorities in St. Paul and Minneapolis.

The clerical work of this department was ably cared for by Miss Nellie Carroll, who served as stenographer and clerk during the entire directorship of both Drs. Reynolds and Brimhall. The laboratory work connected with the study of infectious diseases of animals during Dr. Brimhall's directorship is not equalled in any state in the Union. This was under the supervision of Dr. F. F. Wesbrook who was ably assisted by Drs. L. B. Wilson, O. McDaniel, and E. H. Beckman. After the construction of the building devoted to animal research on the University campus, in 1902, the opportunities for carrying on both the routine and research study of animal diseases through the State Board of Health Laboratory were of the best. This work was practically discontinued when the new Live Stock Sanitary Board came into existence.

That this new Live Stock Board appreciated the workers employed by the State Board of Health in its dealing with infectious diseases of animals is shown by the fact that Dr. Brimhall, Miss Carroll and Mr. Pomplun were transferred from the work of the old to that of the new Board.

In making a final report of the laboratory work of the Minnesota State Board of Health in connection with infectious diseases of animals, it may be well to give a short general statement of the problems which arose, and of the methods utilized in their solution.

Immediately upon the permanent establishment of the laboratory in 1896, specimens and requests for investigation came in from all portions of the state. Throughout the history of the laboratory there has been considerable misconception relative to possibilities for satisfactory examination although every attempt has been made to define the limits of such possibility. It has often happened that the first information received by the State Board of Health concerning disease in animals has been through the forwarding of specimens to the laboratory. In comparatively few of the infectious diseases to which animals are susceptible can information of any great value be derived from a laboratory examination of specimens, unless fullest information concerning the conditions obtaining is furnished at the same time.

Frequently a bottle or jar of partially decomposed tissue is forwarded to the laboratory with a note from the owner of the stock, the local health officer who may or may not be a physician, or sometimes a veterinarian. It has happened in more than one instance that materials have been received without any data whatever other than that afforded by the express companies, who were able to give the addresses of the senders.

In the study of material of this kind, it is easily apparent that very much valuable time may be wasted and no practical results obtained owing to the masking or killing out of the infective organism by the putrefactive or other bacteria which have been introduced and developed during collection and shipment. Preservatives too, are sometimes added, thus killing all bacteria. To meet these and kindred difficulties which may be easily imagined, early in the work a circular of information was prepared in which the objects for which the laboratory was established were set forth and general and specific directions given for the collection and sending of specimens.

So far as possible, the endeavor was made to undertake work in infectious diseases of animals only in collaboration with the Director of the Veterinary Department of the State Board of Health. In the reports given under the various headings in the following pages of this volume, there will be found relatively few instances of satisfactory laboratory investigation of materials forwarded to the laboratory, owing to the fact that special knowledge is necessary before materials can be satisfactorily collected and shipped and the requisite data furnished.

In other states where dependence is placed upon such methods, the experience has been similar and no better way for hampering the acquirement of knowledge can be hit upon than the attempt at such long range work. As a contrast to results obtained by such methods, one has only to glance at the work in hæmorrhagic septicæmia, cerebro-spinal meningitis, swamp fever and certain isolated investigations of anthrax, rabies, etc. The reason for the difference in the results obtained is attributable to the fact that some representative of the laboratory went out into the field so as to begin the investigation with a competent veterinarian at the proper point. In such investigations, the necessary apparatus and supplies were taken from the laboratory so that fresh and preserved microscopic and macroscopic specimens of tissues and fluids might be properly collected, and, if necessary, examined immediately. Cultures were made and data collected before post mortem changes masked the disease processes. (See page 451, Biennial Report, State Board of Health, 1899-1900.) Materials collected by representatives from the Veterinary Department and the laboratory were brought to the laboratory and the studies there completed.

In the investigation of any new or obscure disease, of necessity very much more time is consumed in making the first few examinations than is required for the later cases. Methods are elaborated which conduce to rapidity of work and, furthermore, the observer knows the problem which is before him.

It is quite often impossible to explain satisfactorily to the senders of specimens or those who are anxious for a laboratory investigation, the probable futility of obtaining satisfactory results, nor has it been generally understood that the investigations of the State Board of Health are for the purpose of diagnosing infectious diseases in order that their sources be exactly located and eradicated.

Requests have frequently been made for examination of single cases of sickness in animals or of supposed peculiarities in animal food products, in which no history could be obtained tending to show that the health of man or a number of animals was jeopardized.

Individuals are sometimes ready to ask that many dollars' worth of time and work be given in order to satisfy curiosity or to determine whether the carcass of a single animal is fit for food because the state's money pays for it.

So far as possible, during recent years, attempt has been made to investigate only such diseases as appear to be infectious and those, too, which were threatening to become widespread.

Wherever possible a representative of the bacteriological laboratory accompanied the representative of the Veterinary Department in the investigation of diseases where the laboratory could be of service. In the work on hæmorrhagic septicæmia, swamp fever in horses, cerebro-spinal meningitis, malignant catarrh in cattle and other such diseases, micro-organisms had been isolated from many cases but no facilities existed for the testing of the pathogenesis of the bacteria which had been kept under cultivation and observation. The erection of the Laboratory of Animal Research, completed in the fall of 1902, permitted of the undertaking of this work and attempt has been made to reproduce certain of these diseases by inoculation and feeding experiments in order that prophylactic and curative measures might be instituted. This work could not be brought to a satisfactory conclusion however, owing to the removal of this branch of the work from the control of the State Board of Health in April, 1903.

During 1901-1902, one member of the laboratory force has been continually working on diseases of animals and when special opportunities arose for the investigation of some problem or when demand occurred, the whole laboratory staff was employed on animal disease, due care being taken not to jeopardize the routine work in human disease. Research problems which could be laid aside without harm, were temporarily abandoned for emergency calls in animal investigations.

Much more could have been accomplished were it not for the fact that many calls came for laboratory time and energy to be spent upon materials forwarded to the laboratory for investigation in which there seemed little hope of satisfactory results being obtained. These might well have been ignored in most instances but the fear that opportunity for ascertaining important facts might be lost or that offense might be given to those who had interested themselves in these matters, led to the waste of a very great deal of time without commensurate results. Such risks must be taken by any board interesting itself in this kind of work unless it be possible to answer every call immediately, by the sending of veterinary and laboratory representatives who may frequently find that there is no necessity for any investigation. The traveling expenses of such representatives, however, will be more than offset by the saving of time required in examining valueless specimens and acquiring useless data.

LEGISLATION.

During the legislative session of 1901, a bill was presented by Mr. N. K. Hunt of St. Cloud looking to the removal of infectious diseases of animals from the State Board of Health. Bearing upon this subject a conference was held March 31, 1901, at which was present Senator R. B. Brower, Representatives N. K. Hunt and A. K. Bush, Drs. J. C. Currier, F. D. Ketchum, C. C. Lyford, Richard Price, S. D. Brimhall and J. G. Annand (veterinarians), Mr. N. P. Clark, Mr. Chas. Kenning, Mr. Wm. J. Pomplun, Drs. F. F. Wesbrook, L. B. Wilson of the laboratory and Drs. H. Hutchinson, E.

Shumpik, M. H. Reynolds and H. M. Bracken of the State Board of Health. The Hunt bill was discussed. Its chief point was to establish a live stock commission to consist of three live stock breeders and one veterinarian. After thoroughly considering the subject as to whether infectious diseases of animals should still be left under the State Board of Health or should be placed under such a live stock commissioner as that proposed in the Hunt bill, it was decided to favor the enlargement by legislative act of the present State Board of Health, leaving the infectious diseases of animals still under its control. Dr. Henry Hutchinson, chairman of the conference, was authorized to appoint a committee consisting of three to carry out this plan. Senator Brower, Rrepresentative Bush and Dr. Ketchum were named upon the committee. Neither Senator Brower nor Representative Bush felt that they could well serve in this capacity. Representative Hunt and Dr. Bracken were appointed to serve in their stead. Dr. Bracken expressed his unwillingness to serve on the committee and requested that Dr. Hutchinson should serve in his place, and the request was granted. Mr. Hunt expressed his willingness to withdraw his bill provided the points in which he was interested were covered by the State Board of Health. Mr. Clark, at this time, expressed himself as dissatisfied with veterinarians and their methods of dealing with infectious diseases of animals, judging from a sanitary standpoint. At this conference both Drs. Currier and Reynolds presented certain points which they considered important in the reorganization of this work. On March 14th these points were taken up by the Executive Committee of the State Board of Health, consisting of Drs. Hutchinson, Reynolds and Bracken, with Mr. Harris Richardson (the Board's attorney), at which time it was deemed advisable to make the following recommendation:

First: That the State Board of Health should have in its membership one veterinarian and two stockmen;

Second: That the State Board of Health should have power to appoint a director of the bacteriological department, a director of the veterinary department and a director, or directors, of such other department, or departments, as may in the future be created, such directors to be chosen annually by the board, but not to be members of the board;

Third: That the director of each department should have charge of all correspondence connected directly with his department, and should examine and approve all bills, both for services and materials used in his department and forward the same at the end of each month to the secretary and executive officer of the Board, to be passed upon as prescribed by the law;

Fourth: That the director of each department should submit a quarterly report to the State Board of Health; that he should also suggest to the board for its endorsement, modification or rejection, rules and regulations which he might consider necessary for the proper working of his department;

Fifth: That the State Board of Health should make such rules and regulations for its departments as it might deem necessary.

These recommendations seemed to cover all the points suggested by Dr. Currier the preceding evening, except that but one veterinarian instead of two was called for upon the board, and that the appointments were to be left entirely in the hands of the Governor, as was the case in the appointments of the present members of the board. (Dr. Currier had suggested two veterinarians and two stockmen, the latter to be *nominated by the State Stock Breeders' Association*, to be placed upon the Minnesota State Board of Health by the Governor.) The points presented by Dr. Reynolds were also discussed. Several of these were practically embodied in the suggestions for the new law, while others were considered impractical from a legal point of view. On March 15, Representative Hunt, Drs. Ketchum and Hutchinson, the committee appointed at the Conference meeting to consider the points that had been gone over with Mr. Richardson on the previous day, met. Dr. Bracken was present by request. As a result of this Committee meeting, the following amendment was made to the General Sanitary bill that was already before the Legislature, Mr. Hunt withdrawing his bill calling for the creation of a sanitary live stock commission: First, "The first two vacancies which occur on the State Board (of Health), after the passage of this act, shall be filled by appointment of practical stockmen, and thereafter said board shall at all times be so constituted as to have thereon at least one competent veterinarian and two stockmen. Said board shall have an executive committee. There shall always be one veterinarian and at least one stockman on said committee. There shall be a Veterinary Department, a Bacteriological Department, and such other departments as the board may from time to time create. The Veterinary Department shall be in charge of a director who shall be a competent veterinarian, and who shall not be a member of the Board. The Bacteriological Department shall be in charge of a director, who shall be a competent bacteriologist, and shall not be a member of the board. The directors of other departments shall not be members of the board. The directors of the board shall be appointed at the meeting of the board in January of each year."

Unfortunately, certain parties who had attended the conference already referred to were not satisfied with this wording. In the conference it had been agreed to abide by the action of its committee. In spite of this agreement, however, a "rider" was put upon the above amendment which materially altered its character. This "rider" caused much discussion in the Committee on Public Health in the House and resulted eventually in the death of the entire sanitary bill, including this special feature, in the committee of the House.

During the Legislature of 1903 a bill, formulated by the State Board of Health, was introduced, looking to the correction of sources of hardships in the compensation provided to owners of cattle that had been slaughtered because of tuberculosis, and also providing compensation to owners of glandered horses destroyed on account of that disease. This was known as the Krostue bill. It read as follows:

CHAPTER 141—LAWS OF 1903.

"An Act to Prevent the Spread of Contagious and Infectious Diseases Among Domestic Animals in this State."

Be it enacted by the Legislature of the State of Minnesota:

Section 1. That section four (4) of chapter two hundred and thirty-three (233) of the General Laws of 1897, as amended by chapter three hundred and twenty-two (322) of the General Laws of 1901, be and the same is hereby amended so as to read as follows:

Section 4. No animal shall be killed by any of the boards of health herein mentioned until it shall first have been adjudged to be infected with a contagious or infectious disease either by a duly authorized agent of the state board of health, or by a competent veterinary surgeon selected by a local health officer or board of health; except, that, whenever, in the judgment of the state board of health, the control or eradication of a disease renders it advisable to do so, such board may order killed and buried, or otherwise destroyed, any domestic animal which has been exposed to a contagious or infectious disease, although at the time not infected therewith.

Provided, however, that cattle in this state shall not be adjudged infected with the disease of tuberculosis or condemned as being so infected, and that horses in this state shall not be adjudged infected with the disease of glanders or condemned as being so infected except and until such animal has been inspected by a competent veterinarian under the authority of the state board of health.

Sec. 2. That section five (5) of chapter two hundred and thirty-three (233) of the General Laws of 1897, as amended by chapter three hundred and twenty-two of the General Laws of 1901, be and the same is hereby amended so as to read as follows:

Section 5. Whenever a domestic animal has been adjudged to be infected with a contagious or infectious disease and has been ordered killed, the owner or keeper of such animal shall be notified thereof, and within twenty-four (24) hours thereafter he may file a written protest with the board of health which is responsible for such killing, against the killing thereof, and shall therein state under oath that to the best of his belief such animal is not infected with any contagious or infectious disease. Whereupon such animal being killed notwithstanding such report, a post mortem examination thereof shall be made by experts who shall be present at the killing and shall be appointed one by the board of health, or its representative, which ordered the killing, one by the owner or keeper, and one by the two already appointed, and if upon such examination said animal shall be found to have been entirely free from contagious or infectious disease they shall also appraise it at its cash value immediately before it was killed, and the amount of such appraisal shall be paid to the person entitled thereto out of the funds of the state or the municipality ordering the killing. The experts shall be paid one-half by the owner or keeper making the protest and one-half by the state or municipality whose board of health is responsible for the killing. In case the owner or keeper of such animal shall fail to appoint in writing at the time, an expert as herein provided, an expert shall be appointed by the state board of health or its representative in lieu of the one provided herein by the owner or keeper. All appraisements and examinations made under this act shall be in writing, signed by the appraisers or examiners, certified to by the Board of Health ordering the examination or killing, and filed with the treasurer of the state or of the municipality which is responsible for the examination or killing. Upon the filing of any such examination as appraisal it shall be the duty of the Board of Health which is responsible for the examination or killing to make a certificate under the hand of its secretary as to the number of days served by and the amount due to said experts or appraisers and to file the same with the treasurer of the state or municipality, as the case may be, which is responsible for the examination or killing, and upon such filing, such treasurer shall pay to each of said experts or appraisers the amount due him, and to the person entitled thereto the amount due him by the terms hereof; provided, however, that any expert or appraiser employed on a salary by the Board of Health shall receive no compensation hereunder. Whenever any domestic animal has been adjudged infected with the disease of tuberculosis or glanders and has been ordered killed by a duly authorized representative of the State Board of Health and is killed in accordance therewith after or without protest, the value of such animal shall be determined by a board of appraisers consisting of three competent and disinterested men, one to be appointed by the State Board of Health or its representative, one by the owner or keeper of the condemned animal, within twenty-four (24) hours after the killing is ordered and the third by the two already appointed, who shall appraise it, before it is killed, at its cash value, provided, that in determining such value the fact that such animal was infected by tuberculosis or glanders shall not be taken into consideration, and provided further that in no case shall the appraised value of a horse afflicted with glanders exceed seventy-five (75) dollars, and in no case shall the appraised value of a cow afflicted with tuberculosis exceed thirty-five (35) dollars, and provided that payment shall not be made for any such animal unless such animal is one year old or over, and has been kept in this state in good faith for at least one year next prior to the killing thereof. In case the owner or keeper fails to appoint an appraiser, as herein provided, one shall be appointed on his behalf by the representative of the State Board of Health. The market value of the carcass of the tuberculous animal shall be deducted from the appraised value of the animal, and three-fourths the remainder thereof or three-fourths of the appraised value of the glandered horse shall be paid by the State in the manner hereinbefore set forth to the person entitled thereto who shall bear the remaining one-fourth of the loss. Each appraiser shall receive one (1) dollar a day for his services as appraiser. Whenever any such animal which has been adjudged to be infected is killed by order of said board, but not by the owner or keeper thereof, a post mortem examination thereof shall be made by experts appointed as aforesaid, and if found to have been entirely free from any infectious disease the value of such animal shall be determined, and paid for as hereinbefore specified. Except as in this section expressly provided, no compensation shall be paid for any animal killed by virtue of any authority given by this act.

Sec. 3. This act shall take effect and be in force from and after its passage.

Approved April 8, 1903.

This, an excellent bill, became a law. The bill which also became a law creating a state live stock sanitary board reads as follows:

(Compare this law with Chapter 233, Laws of 1897, and Chapter 322, Laws of 1901.)

CHAPTER 352—LAWS OF 1903.

Be it enacted by the Legislature of the State of Minnesota:

Section 1. That a board is hereby established to be known as "The State Live Stock Sanitary Board." This board shall consist of five (5) members to be appointed by the governor of the State of Minnesota. Each member of said board shall be a qualified elector of the State of Minnesota. Three members of said board shall be persons who are financially interested in the breeding and maintenance of live stock in the State of Minnesota, and two members of said board shall be competent and qualified veterinary surgeons who are graduates of some regularly organized and recognized veterinary colleges practicing in the State of Minnesota.

Sec. 2. In making the first appointments to said State Live Stock Sanitary Board, the governor shall divide the appointees into five classes: the term of office of each of the first appointees shall commence on the first day of April, 1903; one of said appointees shall hold his office for a term of one year; one for the term of two years; one for the term of three years; one for the term of four years; and one for the term of five years; and at the expiration of the term of office of each of the first appointees, a successor shall be appointed who shall hold his office for a term of five years, so that the term of office of one member of said Board shall expire every year. In case of the death, resignation or removal of any member of said board during his term of office, the governor shall appoint a successor to serve the unexpired portion of the term of office of such member.

Sec. 3. Immediately after the appointment of the first board hereinafter provided for, the members thereof shall meet at the city of St. Paul, and from their own number shall elect a president and a vice president. They shall also elect, from outside their number, a secretary, who shall be a graduate of some regularly organized and recognized veterinary college, who shall be the executive officer of said board, and who shall receive such compensation as said State Live Stock Sanitary Board may determine. His term of office shall be one year, and he shall hold his office until his successor is elected and qualified. The said board may also, if it deem expedient, elect a field veterinarian, a bacteriologist and an attorney for said board, which said officers, if elected, shall also hold office for the term of one year, and shall receive such compensation as may be determined by said State Live Stock Sanitary Board. The said State Live Stock Sanitary Board shall also have the power to appoint or employ such additional help as it may deem necessary and expedient for carrying into effect the powers and duties conferred on said board by this act.

Sec. 4. No member of said State Live Stock Sanitary Board shall receive any compensation for any services he may render, either as a member of said board, or to said board, under the provisions of this act, save and except that the members of said board shall receive their actual expenses necessarily paid or incurred in the discharge of their duties as members of said board.

Sec. 5. The said State Live Stock Sanitary Board shall hold quarterly meetings in the city of St. Paul, on the Friday after the second Tuesday in January, April, July and October of each year. The annual meeting of said board for the election of officers shall be on the Friday after the second Tuesday in April of each year.

Sec. 6. It shall be the duty of the said State Live Stock Sanitary Board to protect the health of the domestic animals of the state; to determine and employ the most efficient and practical means for the prevention, suppression, control and eradication of dangerous, contagious, and infectious diseases among the domestic animals of the State of Minnesota, and for these purposes it is hereby authorized and empowered to make all such rules and regulations for the conduct of the business of said State Live Stock Sanitary Board as it may deem expedient.

Sec. 7. It is hereby made the duty of the several local boards of health of the towns, villages, and cities of this state to cooperate with and assist said State Live Stock Sanitary Board in all matters and things pertaining to the prevention, suppression, control and eradication of dangerous, contagious or infectious diseases among the domestic animals of the state, whenever directed so to do by said State Live Stock Sanitary Board or the executive officer thereof, and in such manner as directed by said State Live Stock Sanitary Board.

Sec. 8. All authority conferred upon the State Board of Health by any law of the State of Minnesota concerning the prevention, control, suppression or eradication of contagious or infectious diseases among any of the domestic animals of this state is hereby taken from said State Board of Health and conferred upon said State Live Stock Sanitary Board. The proviso at the end of section four (4) of chapter two hundred and thirty-three (233) of the laws of Minnesota for the year 1897, is hereby repealed.

Sec. 9. Authority is hereby given to the State Live Stock Sanitary Board and to the several local boards of health of the towns, villages and cities of this state, to take all steps they may severally deem necessary to control, suppress and eradicate any and all contagious and infectious diseases among any of the domestic animals in this state, and to that end, said boards are hereby severally empowered, within their respective jurisdictions, to quarantine any domestic animal which is infected with any such disease or which has been exposed to infection therefrom; to kill any animal so infected, and, whenever deemed necessary by the State Live Stock Sanitary Board, to kill any animal which has been exposed to the infection of any such disease; to regulate or prohibit the arrival in or departure from this state, or the arrival in or departure from any of the towns, villages and cities thereof, of any such exposed or infected animal, and at the cost of the owner thereof, to detain any domestic animal found in violation of any such regulation or prohibition; to adopt all such rules and regulations as may be by such several boards deemed necessary or expedient to enforce the authority hereby given; and said State Live Stock Sanitary Board is hereby expressly given authority to regulate or prohibit the shipment into this state of any domestic animal which in the judgment of said board may injure the health of live stock in this state; provided that neither said State Live Stock Sanitary Board nor any local board of health shall, by any rule or regulation thereof, prohibit the sale, disposal or removal of any domestic animal of any person or persons from any place when such animal has no disease or has not been exposed to any contagious disease, and the fact that animals are upon the same premises with other animals having a contagious disease shall not of itself necessarily be construed as evidence of exposure to such a contagious disease as is had by said other animals.

Sec. 10. Any person who knows of or has reason to suspect the existence of any contagious or infectious disease in any domestic animal in the State of Minnesota shall forthwith give notice thereof to the local board of health of the town, village or city wherein such animal is kept. Within twenty-four hours after any local board of health shall receive notice or have knowledge that any domestic animal is infected with any such disease or has been exposed thereto, it shall give notice thereof in writing to the said State Live Stock Sanitary Board.

Sec. 11. All rules and regulations adopted by said State Live Stock Sanitary Board by any local board of health under the authority of this act shall be entered upon the minutes of the board so adopting such rules or regulations and shall be published in a newspaper to be designated by the board making such rule or regulation and in the manner by such rule or regulation prescribed. All regulations now in force adopted by any board of health within this state under authority of any law existing prior to the passage of this act or relating to the matters covered by this act and not in conflict with this law, are continued in force and are hereby declared to be rules and regulations of said State Live Stock Sanitary Board and the several local boards of health of the towns, villages and cities under this act until such times as others are adopted.

Sec. 12. No animal shall be killed by any of the boards herein mentioned until it shall first have been adjudged to be infected with a contagious or infectious disease, either by a duly authorized agent of said State Live Stock Sanitary Board or by a veterinary surgeon selected by a local board of health; except that whenever, in the judgment of said State Live Stock Sanitary Board, the control or eradication of the disease renders it advisable to do so, said State Live Stock Sanitary Board may order killed and buried or otherwise destroyed any domestic animal which has been exposed to a contagious or infectious disease although at the time not infected therewith.

Sec. 13. Whenever a domestic animal has been adjudged to be infected with a contagious or infectious disease and has been ordered killed by said State Live Stock Sanitary Board or by a local board of health, the owner or keeper of such animal shall be notified thereof, and within twenty-four hours thereafter such owner or keeper may file a protest against the killing thereof with the board which has ordered such animal killed. Such notice shall state under oath that to the best of the knowledge and belief of the person making such protest, such animal is not infected with any contagious or infectious disease; whereupon if such animal is killed notwithstanding such protest, a post-mortem examination thereof shall be made by three experts, one of said experts to be appointed by said State Live Stock Sanitary Board; one to be appointed by the person making such protest, and the two thus appointed to choose a third.

If upon post-mortem examination such animal shall be found to have been entirely free from contagious or infectious diseases, there shall be appointed three competent and disinterested men, one to be selected by said State Live Stock Sanitary Board, one by the person making such protest, and the third by the two already appointed, to appraise such animal at its cash value immediately before it was killed, and the amount thereof shall be paid to the owner of said animal out of the funds hereby appropriated for the purpose of carrying out this act.

The appraisements made under this act shall be in writing and signed by the appraisers and certified by the local board of health and the said State Live Stock Sanitary Board respectively, to the auditor of the state, who shall draw a warrant on the state treasurer for the amount thereof.

Sec. 14. The expense of the experts in making the post-mortem examination herein provided for shall be defrayed by said State Live Stock Sanitary Board out of the moneys appropriated for the carrying into effect of this act, in case said experts upon examination find such animal to have been entirely free from contagious or infectious disease. If, however, upon such examination, such animal shall be found to have been infected with a contagious or infectious disease, then the expense of the expert appointed by said State Live Stock Sanitary Board and the third expert shall be paid by the said State Live Stock Sanitary Board out of the funds hereby appropriated for the carrying into effect of this act, and the expense of the other expert shall be paid by the person making the protest. The amount of such expense shall be fixed and allowed by the said Live Stock Sanitary Board and by its certificate to the state auditor, who shall draw his warrant on the state treasurer for the amount thereof.

Sec. 15. Upon the filing of any appraisement hereinbefore provided for, it shall be the duty of the local board of health in the town, village or city where such appraisement shall have been had to make a certificate under their hand of the number of days served by the appraisers in making their appraisement, and upon the filing of such certificate, the said certificate shall be forwarded to the

State Live Stock Sanitary Board and if by said board found to be correct, such fact shall be endorsed on the back thereof and such certificate with such endorsement shall be filed with the state auditor and the state treasurer shall pay to each of said appraisers the sum of two dollars per day for his services as such appraiser upon the warrant of the state auditor, such payment to be made out of the funds herein appropriated.

Sec. 16. Whenever any such animal which has not been adjudged to be infected is killed by order of said board, but not by the owner or keeper thereof, a post-mortem examination thereof shall be made by experts appointed as aforesaid, and if found to have been entirely free from any contagious or infectious disease, the value of such animal shall be determined and paid for as hereinbefore specified.

Sec. 17. The expense of the killing and burial, or destruction, of any diseased animal ordered killed by either of the boards aforesaid shall be borne by the town, village or city where such animal was kept. The expense of the quarantine of any infected animal, or of any animal that has been exposed to infection, when taken from the possession of its owner or keeper, shall be borne, one-fifth by the town, village or city where the animal was kept and four-fifths by the state. When any animal is quarantined upon the premises of the owner or keeper, the expense thereof shall be borne by such owner or keeper. Whenever any animal is quarantined when being shipped into the state, the expenses thereof shall be borne by its owner or keeper. Whenever the owner or keeper of any domestic animal is liable for any expense incurred under this act by the State Live Stock Sanitary Board or by any board of health in connection therewith, such board may have a lien on such animal for such expense, and may also maintain an action against such owner or keeper therefor.

Sec. 18. It is hereby made the duty of the several local boards of health in this state to carry out and enforce all orders and directions of the State Live Stock Sanitary Board to them directed, and the State Live Stock Sanitary Board may require any two or more local boards to act together for the purpose of enforcing any of the provisions of this act.

Sec. 19. Whenever the rules and regulations of the State Live Stock Sanitary Board made under authority of this act conflict with the rules and regulations made hereunder by any local board of health, those made by the State Live Stock Sanitary Board shall supersede those made by the local board.

Sec. 20. The State Live Stock Sanitary Board, or any member or duly authorized agent thereof, may examine or cause to be examined, under oath, all persons believed to possess knowledge of material facts concerning the existence or dissemination, or danger of dissemination, of disease among domestic animals; and, for this purpose, shall have all the powers vested in justices of the peace to take depositions and to compel witnesses to attend and testify.

Sec. 21. Any person violating any provisions of this act or any rule or regulation made by the State Live Stock Sanitary Board, or by any local board of health, or any order made by any such board under the authority hereof, shall be guilty of a misdemeanor, and be punished by a fine of not less than twenty-five (25) dollars or more than one hundred dollars, or by imprisonment for not less than thirty (30) days or more than ninety (90) days. Any member of any local board of health who shall neglect or refuse to carry into effect the provisions of this act, or who shall neglect or refuse to carry out any direction of the State Live Stock Sanitary Board, or who shall neglect or refuse to enforce any rule or regulation made by the State Live Stock Sanitary Board, or by any local board of health under the authority hereof, shall be guilty of a misdemeanor and be punished by a fine of not less than twenty-five (25) dollars and not more than one hundred (100) dollars; and each and every day's neglect or refusal to perform any duty imposed upon him by this act shall constitute a separate and independent misdemeanor. Complaints for violating the provisions of this act, or for violating any rule or regulation made by the State Live Stock Sanitary Board or by any board of Health under its authority, or by the said State Live Stock Sanitary Board, may be made by any member or authorized agent of any such board, or by any citizen of this state, or by any person directly interested.

Sec. 22. Whenever, during the prevalence in this state of any contagious or infectious disease among domestic animals, the owner shall post on his premises a notice forbidding all persons not authorized by said State Live Stock Sanitary Board or local boards of health to enter any building or inclosure on said premises without permission from said owner, it shall be a misdemeanor to enter upon said premises, punishable by a fine of not less than twenty-five (25) dollars, nor more than one hundred (100) dollars, or by imprisonment for not less than thirty (30) nor more than ninety ((90) days.

Sec. 23. The said State Live Stock Sanitary Board shall make an annual report to the governor of Minnesota of all its proceedings and transactions for the preceding year, which said report shall be published by the State of Minnesota.

Sec. 24. The State Board of Health is hereby directed to turn over and deliver to said State Live Stock Sanitary Board, immediately upon the appointment of said board, all books, papers, documents and files of said State Board of Health pertaining or relating to contagious or infectious diseases of domestic animals, either in Minnesota or elsewhere.

Sec. 25. The annual appropriation, made for the use of the State Board of Health by the provisions of section twelve (12) of chapter (233) two hundred and thirty-three of the Laws of Minnesota for the year 1897 as amended by section two (2) of chapter three hundred and twenty-two (322) of the Laws of Minnesota for the year 1901, is hereby transferred from said State Board of Health and granted and appropriated to said State Live Stock Sanitary Board for the carrying into effect the purposes of this act; and any moneys which at the time of the passage of this act remain unexpended out of said annual appropriation for the fiscal year ending July 31st, 1903, is hereby transferred from said State Board of Health and granted and appropriated to said State Live Stock Sanitary Board.

Sec. 26. All acts and parts of acts inconsistent with this act are hereby repealed.

Sec. 27. This act shall take effect and be in force from and after its passage.

Approved April 21, 1903.

INFECTIOUS DISEASES OF ANIMALS.

BOVINE TUBERCULOSIS.

In 1897 Minnesota passed a law providing for the condemnation of cattle responding to the tuberculin test. (See Chapter 233.) This law had a clause requiring two tests, however, before any animal could be condemned, the tests to be not less than two or more than three months apart. This proviso was not considered necessary by the veterinarians or sanitarians, but was insisted upon by the dairymen, and was granted by those interested in order to secure the passage of the bill.

This proviso was a great hardship, for it compelled the keeping of cattle that had responded to the first test in quarantine until the second test, and during this period the milk or its products could not be used. There was thus inconvenience and expense without any return. This law continued in force until the passage of the Krostue bill in 1903. (See page—) When the above law went into effect Minneapolis was trying to secure a non-tuberculous milk supply through the use of the tuberculin test. The courts had determined the right of the city to test cattle within the city limits and to exclude milk from the city unless it came from tested herds. The city had no legal right to test cows outside of its jurisdiction, but many dairymen gave the city inspectors permission so to do rather than have their milk excluded from the Minneapolis market. In the fall of 1899 St. Paul began the testing of dairy herds as a means of securing a non-tuberculous milk supply. The Twin Cities had no jurisdiction outside of their limits to establish or maintain quarantine on animals condemned by the tuberculin test. In order to aid in this apparently laudable task the State Board of Health appointed an inspector, Mr. W. J. Pumplum, to act through the various local boards of health (township and village) in the quarantine of condemned animals outside of the cities' jurisdiction. The dairymen were great financial losers through this law, for they received nothing for their condemned cattle. At the same time no provision was made by which they might buy tested cattle; hence after the testing of their herds, with a condemnation of some of the cattle, there was nothing for them to do but buy other cows of which they had no assurance that they were any better than those just condemned and slaughtered.

In 1901 the legislature passed a bill (Chapter 322) providing compensation to owners of condemned tuberculous animals, the state to pay one-third and the local sanitary district to pay one-third of the appraised valuation of an animal, such appraisal in no instance to exceed forty dollars. This law was of great aid to the dairymen but a burden to the country districts (townships and villages), and in some instances townships were governed in their election of officers by a pledge from the candidates to the effect that they would resist the payment of any such claims against the township. This burden upon the township was removed by the Krostue bill in 1903. (See page 17) Conferences were held from time to time between the State Board of Health and the health commissioners of St. Paul and Minneapolis relative to the best means of securing dairy herds free from animals that would react to the tuberculin test.

In May, 1901, the state officials proposed the establishment of one or more dairy marts in the Twin Cities where tested cows could be purchased. Dairymen had expressed their willingness to pay five dollars more for tested than non-tested cattle. The state could not establish such marts in any sanitary district without the permission of the local authorities for the locality would be responsible for one-third the appraised valuation of the condemned animals. The state officials felt that it would be cheaper for the cities to inspect and condemn infected cows before they went into a herd than to allow them to enter a herd when they might not be inspected within a year after purchase. They also felt that the state could well afford to conduct the testing at such dairy marts without charge. If this proposition had been accepted the city authorities could have given their time and attention to inspection of dairies as to general sanitary conditions—cleanliness, ventilation, care of milk, etc. The city boards of health did nothing towards meeting this proposition.

No material changes were made by the city boards of health, in their methods of testing. Cows were condemned and killed, and others were bought to take the place of those condemned without any assurance that the newly purchased animals were any better than the condemned animals whose place they took. Still further, the dairymen were constantly buying fresh cows to place in their herds. The city testing did not on an average reach any herd oftener than once a year. A dairyman might have very few tested cattle by the time the inspection reached him. The city milk consumers in the meantime were under the impression that they were purchasing milk from tested cows. As the state was spending quite an amount of money on this testing of cows in and near the Twin Cities it seemed but right that it should take steps to determine what progress was being made. An inspector was sent to the dairies in and near to the Twin Cities. Among other things he was to find out what percentage of the cows in the herd were tested cows at the time of his visit. The result is shown as follows:

	—Percentage of—	
	Tested Cows.	Non-tested Cows.
St. Paul	78	22
Country near St. Paul	59	41
Minneapolis	69	31
Country near Minneapolis	65	35

Taking the city and neighboring country districts for St. Paul and Minneapolis we find the following:

	—Percentage of—	
	Cows Tested.	Cows not Tested.
For St. Paul	68.5	31.5
For Minneapolis	67	33

It will thus be seen that the conditions were much the same for both cities viz.: about two-thirds of the cows in and near the cities were tested and this may be taken as a fair statement of actual conditions.

It must not be overlooked, however, that a large proportion of the milk supplying both cities is shipped in by rail from distant points and from non-tested herds. The amount of milk from tested cows supplied either city is in all probability far below fifty per cent. Thus all this expense of testing cattle, judging from the consumer's standpoint, avails but little. The dairyman, in his own interests, should see that his herd is free from tuberculosis, and he may well use the tuberculin test as a means of so doing. So far as a pure milk supply is concerned it would appear that a close inspection of dairies as to their general condition would accomplish much good. The following table gives some idea of what our inspectors found. The inspection was made in late winter and early spring.

INSPECTION OF DAIRIES.

ST. PAUL.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
1	11	2	fair	milk house	wet	dark, damp.
2	18	6	good	milk house (dirty)	dry	damp, bad air.
3	7	1	fair	milk sold at once	wet	damp, poor ventilation.
4	8	7	fair	milk house	dry	damp, poor ventilation.
5	15	1	fair	milk house	wet	dirty, poor ventilation.
6	15	8	good	tank (dirty)	dry	dark, fair ventilation.
7	18	2	fair	milk house	dirty	damp, poor ventilation.
8	11	3	fair	shed (dirty)	dry	light, bad ventilation.
9	27	0	poor	tank outside	wet	poor generally.
10	9	1	poor	dwelling house	dry	dirty, no ventilation.
11	3	1	fair	sold at once.	wet	fair, no ventilation.
12	6	2	fair	cistern	dry	damp, no ventilation.
13	17	6	fair	milk house	clean	good, well ventilated.
14	18	8	good	milk house	dry	dry, poor ventilation.
15	0	7	poor	milk house	dry.	dirty, bad.
16	20	23	fair	milk house	good	fair.
17	8	8	fair	milk house (dirty).	poor	damp, poor ventilation.
18	10	7	dirty	tank (dirty)	wet	bad.
19	19	2	fair	milk house	dirty	poor.
20	11	2	good	milk house	dry.	damp, no ventilation.
21	6	2	good	milk house	dry	damp, fair ventilation.
22	18	1	fair	milk house	wet	bad, unsanitary.
23	8	2	fair	shed	dirty	unsanitary.
24	21	1	fair	shed	dry	damp, poor ventilation.
25	14	10	fair	milk house	dry	damp, poor ventilation.
26	18	2	fair	milk house	dry	unsanitary.
27	22	1	fair	milk house	dirty	dry, well ventilated.
28	13	1	dirty	milk house	wet	very unsanitary.
29	13	0	fair	milk house	wet	damp, poor ventilation.
30	12	4	fair	cellar	fair	damp, fair ventilation.
31	22	6	fair	milk house	wet	damp, poor ventilation.
32	12	1	fair	dwelling house	dirty	damp, poor ventilation.
33	18	13	fair	milk house	damp	damp, poor ventilation.
34	14	2	fair	milk house	wet	damp, poor ventilation.
35	16	14	good	milk house	damp	damp, poor ventilation.
36	12	6	good.	milk house	dirty	unsanitary.
37	8	5	poor (dirty)	dirty shed.	good	damp, poor ventilation.
38	11	5	good	cellar	dry	damp, poor ventilation.
39	1	2	dirty	dwelling house	good.	damp, no ventilation.
40	20	5	dirty	milk house	dry	damp, poor ventilation.
41	27	7	fair	outside tank	dry	generally good.
42	10	2	fair	milk house	good	good.
43	11	1	good	milk house	dirty	fairly good.
44	50	2	good	outside tank	dry	good.
45	21	0	dirty	milk house (dirty).	good	poor ventilation.
46	12	6	dirty	outside tank	poor	bad.
47	21	2	fair	milk house	dry	unclean, ventilation fair.
48	55	9	fair	shed	dry	damp, not well ventilated.
49	65	12	clean	barn	good	fair.
50	34	4	clean	milk house	dry	fair.
51	83	2	clean	milk house	excellent.	good, fair.
52	12	4	dirty	milk house	wet	dirty, damp.
53	7	2	fair	sold at once	good	damp, no ventilation.
54	15	2	fair	milk house	damp	fair, poor ventilation.
55	13	5	fair	milk house	good.	fair, poor ventilation.
56	7	0	good	milk house	clean	dirty, no ventilation.
57	15	2	fair	milk house	bad	fair, poor ventilation.
58	14	4	fair	milk house	dry	good, fair ventilation.
59	7	2	fair	milk house	fair	poor ventilation.
60	24	1	fair	milk house	wet	poor, poor ventilation.
61	14	10	fair	outside tank	dry	damp, poor ventilation.
62	24	8	fair	milk house (bad)	fair	poor, ventilation poor.
63	4	0	fair	sells at once	good	fair, fair ventilation.
64	14	2	good	milk house	fair	damp, no ventilation.
65	4	1	fair	sold at once	good	no drain, damp.
66	19	13	fair	milk house	wet, dirty	dirty, damp, poor ventilation.

INSPECTION OF DAIRIES.—Continued.

ST. PAUL.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
67	20	0	fair	milk house	poor	dark, damp, dirty.
68	74	11	good	milk house	dirty	good, fair ventilation.
69	13	3	fair	milk house	dirty	damp, dirty.
70	2	2	fair	milk house	good	good.
71	7	7	fair	milk house	good	damp, not well ventilated.
72	24	0	fair	milk house	good	dark, not well ventilated.
73	25	7	good	milk house	good	poor ventilation.
74	15	2	fair	milk house	dry	damp, poor ventilation.
75	13	2	poor	milk house	good	damp, poor ventilation.
76	14	8	fair	milk house	no drain	damp, poor ventilation.
77	13	4	fair	milk house	fair	damp, not well ventilated.
78	35	1	fair	milk house	fair	damp, not well ventilated.
79	15	39	fair	milk house	fair	damp, dirty, poor ventilation.
80	10	0	fair	milk house(dirty).	good	damp, dark, dirty.
81	35	7	good	milk house	good	dry, well ventilated.
82	5	2	fair	outside	good	dry, not well ventilated.
83	10	4	fair	milk house	fair	dark, damp, fair ventilation.
84	12	19	fair	milk house	good	dark, dirty, damp.
85	16	1	fair	milk house	good	damp, poor ventilation.
86	24	0	good	milk house	good	dark, damp, dirty.
87	19	0	fair	outside	dirty	dark, damp, poor ventilation.
88	7	5	fair	milk house	poor	dark, damp, poor ventilation.
89	20	6	good	milk house	good	damp, poor ventilation.
90	6	9	fair	milk house		dirty, dark, poor ventilation.
91	1	16	good	milk sold at once	good	damp, poor ventilation.
92	10	12	good	milk house	good	dry, fair ventilation.
93	31	1	good	milk house	good	poor ventilation.
94	31	1	fair	milk house	good	damp, dirty, vent. not used.
95	13	0	fair	milk house	good	dark.
96	23	16	good	milk house	fair	dark, dry, poor ventilation.
97	19	0	fair	milk house	dirty	damp, poor ventilation.
98	12	2	poor	milk house	good	dark, dry, poor ventilation.
99	22	1	fair	tank in shed (dirty)	fair	dark, damp, poor ventilation.
100	0	4	fair	uses the milk	good	dark, dirty, no ventilation.
101	6	1	fair	dwelling	good	dry, poor ventilation.
102	11	5	good	sells at once	dry	damp, poor ventilation.
103	5	0	good	milk house	good	no ventilation.
104	19	1	good	milk house	fair	dry, fair ventilation.
105	5	1	good	sells at once	good	no ventilation.
106	6	5	fair	tank	good	damp, poor ventilation.
107	6	0	fair	cellar	good	dry, poor ventilation.
108	11	0	poor	dwelling house	good	dirty, damp.
109	13	5	poor	shed (dirty)	good	damp.
110	15	8	fair	kitchen (dirty)	fair	dirty, fair ventilation.
111	13	2	fair	cellar	dirty	damp, dirty.
112	5	1	fair	dwelling house	dry	damp, poor ventilation.
113	8	1	fair	cellar	dirty	damp, dirty.
114	29	1	fair	shed	good	damp, poor ventilation.
115	15	9	fair	milk house	fair	damp, poor ventilation.
116	43	0	excellent	milk house	good	dry, fair ventilation.
117	7	9	fair	shed	fair	damp, poor ventilation.
118	7	0	fair	milk sold at once	bad	unsanitary.
119	9	2	fair	cellar	fair	damp, dirty, poor ventilation.
120	21	2	fair		bad	dark, damp, dirty.
121	9	18	fair	milk house	dirty	dirty.
122	8	8	good	tank	good	fair ventilation.
123	13	4	fair	tank	dirty	poor ventilation.
124	9	8	good	milk house	dirty	damp, poor ventilation.
125	10	4	fair	cellar	good	fair ventilation.
126	12	0	fair	milk house	dry	dark, damp, poor ventilation.
127	23	10	fair	milk house	dry.	damp, poor ventilation.
128	16	0	fair	milk house (dirty)	bad	unsanitary.
129	29	4	fair (dirty)	shed	bad	damp, dirty, fair ventilation.
130	17	2	fair	cellar	fair	dry, fair ventilation.
131	7	4		tank	bad	damp, no ventilation.
132	9	2	fair	milk house	fair	damp, poor ventilation

INSPECTION OF DAIRIES.—Continued.

ST. PAUL.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
133	1	5	fair (dirty)	sells at once	good	dark, damp, poor ventilation.
134	5	0	fair	sells at once	good	dry, poor ventilation.
135	11	8	fair	milk house	dirty	damp, no ventilation, dirty.
136	4	0	fair	tank	wet	dark, dirty, no ventilation.
137	3	1	fair	sells at once	wet	dark, no ventilation.
138	60	22	fair	milk house	dirty	dark, damp, poor ventilation.
139	7	2	fair	milk house	bad	unsanitary.
140	7	6	fair	milk house	fair	poor ventilation.
141	3	7	fair	shed	fair	unsanitary.
142	3	6	fair	shed	fair	unsanitary.
143	9	23	fair	shed	wet	dark, damp, poor ventilation.
144	3	1	fair	milk house	good	dry and fair ventilation.
145	19	0	fair	shed (dirty)	dirty	dirty, poor ventilation.
146	0	0				
147	41	17	fair	milk house	wet	dark, damp, poor ventilation.
148	29	1	good	milk house	good	good.
149	13	0	fair	milk house	good	dry, poor ventilation.
150	20	2	fair	milk house (dirty)	wet	fair.
151	7	0	fair	milk house	dry	dry, no ventilation.
152	20	4	fair	sells at once	dry	dark, poor ventilation.
153	10	1	good	tank	good	damp, poor ventilation.
154	22	3	poor	milk house	fair	dark, damp, fair ventilation.

ROSE TOWNSHIP.

155	29	5	good	milk house	fair	dark, damp, poor ventilation.
156	31	5	good	milk house	fair	damp, poor ventilation.
157	1	42	good	milk house	good	dark, damp, poor ventilation.
158	6	41	fair	milk house	good	damp, poor ventilation.
156	0	0	fair	milk house	good	dirty, damp, poor ventilation.
160	3	22	good	milk house	good	good light, dry, well ventilated.
161	26	15	fair	milk house (dirty)	good	damp, poor ventilation.
162	2	17	good	milk house	good	dry, poor ventilation.
163	8	18	fair	milk house	good	damp, well ventilated.
164	13	10	fair	milk house	good	dry, not well ventilated.
165	8	43	good	milk house	good	damp, no ventilation.
166	33	9	fair (dirty)	milk house	good	dry, poor ventilation.
167	18	20	fair	milk house	good	dark, dry, well ventilated.
168	28	7	good	milk house	good	dark, dry, fair ventilation.
169	8	3	fair	milk house	good	damp, poor ventilation.
170	4	42	good	milk house	good	damp, poor ventilation.
171	8	52	poor (dirty)	milk house	dirty	damp, poor ventilation.
172	30	1	fair	milk house	fair	damp, poor ventilation.

MOUNDS VIEW TOWNSHIP.

173	23	23	good	milk house	good	excellent.
174	27	43	excellent	milk house	good	dry, fair ventilation.
175	11	28	good	milk house	good	dry, fair ventilation.
176	24	9		milk house	fair	dry, fair ventilation.
177	58	7		milk house	wet	dark, not well ventilated.
178	8	20	fair	milk house	wet	poor ventilation.
179	12	21	good	shed	fair	dry, fair light and ventilation.
180	24	9	fair	milk house	good	dark, fair ventilation.
181	18	14	good	milk house	good	fair.

INSPECTION OF DAIRIES.—Continued.

NEW CANADA TOWNSHIP.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
182	12	7	fair	?	fair	dirty, damp, poor ventilation.
183	12	1	fair	milk house	good	poor ventilation.
184	13	0	fair	milk house	good	damp, no ventilation.
185	54	6		milk house	good	fair ventilation.
186	12	3	fair	milk house	dirty	poor ventilation.
187	22	0	fair	milk house	dirty	damp, poor ventilation.
188	0	5	fair		dry	poor ventilation.
189	11	6	fair	outside	fair	damp, poor ventilation.
190	14	10	fair	dwelling	dry	damp, fair ventilation.
191	10	2	fair	milk house	dirty	damp, poor ventilation.
192	12	0	fair (dirty)	milk house	wet	dark, damp, poor ventilation.
193	6	1	fair	dwelling	dry	dark, dry, poor ventilation.
194	2	8	fair	dwelling house	dry	dry, fair ventilation.
195	12	7	fair	milk house	wet	dry, fair ventilation.
196	24	13	fair	milk house	good	damp, dark, fair ventilation.
197	39	20		tank	wet	unsanitary.
198	5	3	fair	tank	dirty	dark, dirty.

LILLYDALE, DAKOTA COUNTY.

199	9	7	good	cellar	dry	damp, poor ventilation.
200	44	3	fair	barn	dry	dark, damp, poor ventilation.
201	0	19	good	milk house	wet	damp, fair ventilation.
202	7	0	fair	milk house	good	damp, fair ventilation.
203	10	9	fair (dirty)	shed	dirty	damp, dirty, poor ventilation.
204	16	0	fair	outside	good	damp, poor ventilation.
205	6	0	fair	milk house	dry	dark, poor ventilation.
206	5	6	good	milk house	wet	poor ventilation.

MENDOTA, DAKOTA COUNTY.

207	17	3	fair (dirty)	barn	good	damp, poor ventilation.
208	10	2	fair (dirty)	outside	wet	damp, poor ventilation.
209	16	5	good	shed	fair	damp, poor ventilation.
210	14	0	fair	tank	good	damp, poor ventilation.
211	10	3	poor	milk house	good	damp, poor ventilation.
212	9	3	fair	outside	good	damp, poor ventilation.

WOODBURY, WASHINGTON COUNTY.

213	6	3	?	tank	wet	dark, dry, poor ventilation.
214	8	3	good	tank	good	dry, poor ventilation.
215	23	1	good	tank	wet	damp, dirty, poor ventilation.

SOUTH ST. PAUL, DAKOTA COUNTY.

216	28	10	fair	milk house	wet	damp, fair ventilation.
217	12	25	good	milk house	good	dry, fair ventilation.
218	7	8	fair	milk house	good	dirty, poor ventilation.

INSPECTION OF DAIRIES.—Continued.

WASHINGTON COUNTY.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
219	14	3	fair	tank	good	dry, poor ventilation.
220	11	10	good	milk house	good	dry, poor ventilation.
221	6	8	fair	tank	good	damp, poor ventilation.
222	21	3	good	milk house	dry	poor ventilation.
223	35	0	fair	tank	dirty	damp, poor ventilation.

MINNEAPOLIS.

Record No.	No. Tested.	No. Not Tested.	Condition of Cattle.	Milk Kept In.	Outside.	Inside.
224	10	9	good	barn	wet	damp, fair light and ventila'n.
225	0	10	good	milk house	dry	damp, no ventilation.
226	55	7	fair	milk house	wet	damp, dirty, fair ventilation.
227	16	0	fair	milk house	fair	light, dry, poor ventilation.
228	1	2	good	sells at once	good	fair light and ventilation.
229	10	10	fair	milk house	wet	damp, no ventilation.
230	7	17	good	milk house	....	dry, fair ventilation.
231	4	25	fair	shed	wet	dark, damp, poor ventilation.
232	11	3	dirty	....	dirty	dirty, poor ventilation.
233	6	11	poor	milk house	wet	unsanitary.
234	1	7	fair	milk house	good	damp, dirty, poor ventilation.
235	2	3	fair	sells at once	wet	dark, poor ventilation.
236	51	11	good	milk house	dirty	dark, damp, poor ventilation.
237	4	6	poor	....	good	dark, dirty, poor ventilation.
238	6	11	dirty	milk house	dry	dry, poor ventilation.
239	15	2	good	milk house	good	light, dry, fair ventilation.
240	18	6	good	milk house	good	dry, poor ventilation.
241	35	18	fair	shed	dry	dark, damp, poor ventilation.
242	4	5	good	milk house	good	dark, dry, poor ventilation.
243	0	3	fair	dwelling house	good	damp, poor ventilation.
244	17	8	fair	milk house	dry	dark, dry, fair ventilation.
245	22	15	good	milk house	good	dry, poor ventilation.
246	11	11	fair	milk house	good	damp, no ventilation.
247	0	17	good	milk house	good	dark, damp, poor ventilation.
248	13	0	good	milk house	good	light, dry, well ventilated.
249	27	5	good	milk house	good	light, dry, well ventilated.
250	14	0	fair	milk house	good	light, dry, fair ventilation.
251	22	0	good	milk house	clean	light, dry, well ventilated.
252	16	4	good	milk house	clean	light, dry, well ventilated.
253	20	11	good	milk house	good	light, dry, fair ventilation.
254	8	1	good	milk house	fair	light, dry, well ventilated,
255	28	9	good	barn	good	light, dry, fair ventilation.
256	7	2	good	milk house	fair	dark, dry, poor ventilation.
257	11	16	good	milk house	good	light, dry, poor ventilation.
258	7	6	fair	milk house	wet	light, dry, poor ventilation.
259	29	1	good	milk house	fair	dark, damp, fair ventilation.
260	29	1	good	milk house	good	light, dry, fair ventilation.
261	30	12	fair	milk house	fair	light, dry, fair ventilation.
262	3	0	fair	milk house	good	light, dry, poor ventilation.
263	3	13	good	milk house	fair	dark, damp, poor ventilation.
264	35	0	good	milk house	damp	dark, damp, poor ventilation.
265	2	7	good	sells at once	fair	unsanitary.
266	0	14	good	milk house	good	dry, dark, poor ventilation.
267	16	12	good	milk house	bad	dry, poor ventilation.
268	15	13	good	shed	good	dark, dry, fair ventilation.
269	9	15	fair	outside	fair	dark, damp, poor ventilation.
270	4	5	fair	milk house	fair	dark, damp, fair ventilation.
271	5	13	fair	milk house	good	dark, dry, poor ventilation.
272	7	8	fair	milk house	good	damp, poor ventilation.
273	25	4	good	milk house	good	dark, dry, poor ventilation.
274	23	17	excellent	milk house	good	dark, damp, poor ventilation.
275	12	10	good	milk house	good	light, dry, well ventilated.
276	15	12	good	milk house	poor	dry, poor ventilation.
277	20	6	good	milk house	good	dark, dry, poor ventilation.
278	0	18	good	milk house	good	light, dry, poor ventilation.

INSPECTION OF DAIRIES.—Continued.

MINNEAPOLIS.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
279	17	0	fair	milk house	good	light, dry, well ventilated.
280	20	5	good	milk house	good	light, dry, well ventilated.
281	10	3	good	milk house	good	light, dry, well ventilated.
282	5	3	good	milk house	good	light, dry, well ventilated.
283	11	2	good	milk house	good	light, dry, well ventilated.
284	31	1	good	milk house	fair	light, damp, well ventilated.
285	35	3	good	milk house	fair	light, dry, well ventilated.
286	19	10	good	milk house	good	light, dry, poor ventilation.
287	23	0	good	milk house	good	light, dry, half ventilated.
288	21	2	fair	milk house	good	dark, dry, fair ventilation.
289	20	5	fair	milk house	good	light, dry, fair ventilation.
290	0	15	good	milk house	clean	dry, not well ventilated.
291	0	6	fair	milk house	clean	light, dry, well ventilated.
292	12	2	fair	milk house	good	dark, dry, poor ventilation.
293	40	23	good	milk house	good	dark, damp, poor ventilation.
294	16	3	fair	shed near barn	fair	damp, light, poor ventilation.
295	8	3	good	milk house	good	dark, dry, well ventilated.
296	11	0	fair	away from barn	clean	dark, dry, fair ventilation.
297	20	0	good	away from barn	good	light, dry, well ventilated.
298	19	0	good	milk house	good	dark, dry, well ventilated.
299	30	0	good	in barn	good	light, dry, well ventilated.
300	10	3	good	milk house	good	dark, dry, well ventilated.
301	42	0	fair	milk house	wet	light, dry, well ventilated.
302	40	0	fair	milk house	good	light, dry, fair ventilation.
303	4	3	good	milk house	good	light, dry, good ventilation.
304	36	0	good	milk house	good	light, dry, poor ventilation.
305	44	0	fair	milk house	fair	dark, dry, well ventilated.
306	23	0	good	milk house	good	light, dry, well ventilated.
307	25	0	fair	milk house	good	light, dry, not well ventilated.
308	20	0	good	milk house	good	light, dry, well ventilated.
309	12	0		sells at once	good	light, dry, well ventilated.
310	23	0	good	milk house	fair	damp, fair light and ventila'n.
311	0	5		milk house	good	light, dry, fair ventilation.
312	14	8		milk house	fair	light, damp, fair ventilation.
313	7	3	fair	milk house	fair	dark, dry, fair ventilation.
314	25	0	good	milk house	good	light, dry, well ventilated.
315	10	8	fair	milk house	good	dark, dry, poor ventilation.
316	22	1	good	milk house	good	light, dry, fair ventilation.
317	10	0		milk house	good	dark, dry, poor ventilation.
318	18	2	good	milk house	good	light, dry, fair ventilation.
319	15	25	good	milk house	good	light, dry, well ventilated.
320	17	1		milk house	good	light, dry, fair ventilation.
321	14	4	good	milk house	good	light, dry, well ventilated.
322	2	2		milk house	good	light, dry, well ventilated.
323	85	15	good	milk house	good	dark, dry, fair ventilation.
324	5	15	fair	upstairs in barn	good	light, damp, poor ventilation.
325	8	6	good	cellar		light, damp, poor ventilation.
326	5	23	poor	milk house	dirty	dark, dirty, poor ventilation.
327	5	12	fair	upstairs in barn	bad	fair light, poor ventilation.
328	10	14	fair	dwelling	good	dark, dry, fair ventilation.
329	7	2	fair	dwelling	good	dirty, damp, no ventilation.
330	10	6	fair	cellar	good	light, damp, poor ventilation.
331	1	6		dwelling	good	dark, damp, poor ventilation.
332	8	12	fair	dwelling	good	light, damp, no ventilation.
333	0	14	fair	dwelling	dry	dark, damp, poor ventilation.
334	7	2	good	shed	dirty	poor light, damp, poor vent.
335	9	11	good	dwelling	good	light, damp, poor ventilation.
336	13	0		in barn	good	light, dry, fair ventilation.
337	6	5		in barn	good	light, dry, well ventilated.
338	1	4	fair	sells at once	fair	light, damp, no ventilation.
339	8	0	fair	sells at once	good	dark, damp, fair ventilation.
340	7	0	fair	sells at once	wet	light, dry, well ventilated.
341	2	9	fair	milk house	clean	light, poor ventilation.
342	0	2	fair	sells at once	dirty	light, damp, fair ventilation.
343	1	1	dirty		dry	poor light, dirty.

INSPECTION OF DAIRIES.—Continued.

MINNEAPOLIS.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
344	15	1	fair	cellar	dry	light, damp, no ventilation.
345	11	2	fair	dwelling	good	light, damp, poor ventilation.
346	11	10	fair	dirty shed	dry	dark, dirty, poor ventilation.
347	16	14	fair	milk house	dirty	light, damp.
348	0	6	good	sells at once	clean	light, fair ventilation.
349	20	3	fair	sells at once	dirty	dirty, dark, damp, no vent'n.
350	15	1	poor	seils at once	wet.	dark, damp, poor ventilat'n.

ST. ANTHONY TOWNSHIP, HENNEPIN COUNTY.

351	29	10	good	milk house	wet	light, dry, poor ventilation.
352	2	5	fair	dwelling	good	clean, light, damp, poor vent.
353	22	6	excellent	milk house	clean	light, damp, poor ventilation.
354	14	11	fair	milk house	fair	light, dry, poor ventilation.

ST. LOUIS PARK.

355	10	10	good	milk house	dirty	light, damp, fair ventilation.
356	90	46	good	milk house	good	light, dry, well ventilated.
357	27	0	...	barn	good	light, dry, fair ventilation.
358	32	8	good	barn	good	light, damp, fair ventilation.
359	40	5	fair	milk house	wet	light, dry, well ventilated.
360	4	37	fair	milk house	good	...
361	14	4	good	milk house	fair	dark, dry, fair ventilation.
362	15	11	...	milk house	good	light, dry, well ventilated.
363	24	15	good	room near barn	...	light, dry, fair ventilation.
364	18	9	good	milk house	good	dry, light, well ventilated.
365	15	3	fair	milk house	...	light, dry, fair ventilation.
366	13	13	...	milk house	good	light, dry, well ventilated.
367	18	3	fair	milk house	good	light, dry, well ventilated.
368	10	9	...	milk house	fair.	light, dry, well ventilated.
369	12	20	good	milk house	good	light, dry, fair ventilation.
370	7	13	good	milk house	good	light, dry, fair ventilation.
371	38	19	...	milk house	good	light, dry, well ventilated.
372	21	0	good	milk house	good	light, dry, well ventilated.
373	21	4	good	milk house	good	dark, dry, fair ventilation.
374	11	10	good	milk house	good	dark, dry, fair ventilation.
375	59	6	good	milk house	good	light, dry, fair ventilation.
376	64	6	good	milk house	good	light, dry, poor ventilation.
377	6	10	good	milk house	good	light, dry, well ventilated.
378	16	26	excellent	milk house	good	light, well ventilated.
379	10	26	good	milk house	good	...
380	8	10	good	milk house	good	light, dry, ventilated.
381	30	10	good	in barn	good	light, dry, well ventilated.
382	20	10	good	in barn	good	light, dry, fair ventilation.
383	14	4	fair	in barn	fair.	light, dry, fair ventilation.
384	17	7	...	in barn	good	light, dry, well ventilated.
385	15	6	fair	cellar	fair.	light, damp, fair ventilation.
386	0	22	...	in barn	good	light, dry, fair ventilation.
387	69	7	...	in barn	fair.	light, dry.

INSPECTION OF DAIRIES.—Continued.

RICHFIELD TOWNSHIP.

Record No.	Herd. No. Tested.	Herd. No. Not Tested.	Condition of Cattle.	Milk Kept In.	Condition of Stable. Outside.	Condition of Stable. Inside.
388	30	6	fair.	milk house	no drain.	light, dry, fair ventilation.
389	28	0	good	milk house	good	light, dry, well ventilated.
390	8	5	good	milk house	clean	
391	45	0	good	milk house	excellent.	light, dry, well ventilated.
392	35	8	good	milk house	good	light, dry, well ventilated.
393	16	0		milk house	good	light, dry, well ventilated.
394	22	0	fair.	milk house	good	light, dry, fair ventilation.
395	17	3	good	milk house	good	light, dry, well ventilated.
396	0	4	good			
397	12	1	good	milk house	good	light, dry, well ventilated.
398	10	2	good	milk house	good	light, dry, well ventilated.
399	24	6	good	milk house	fair.	dark, dry, poor ventilation.
400	20	5	excellent.	milk house	good	light, dry, fair ventilation.
401	20	10	good	milk house	good	dark, dry, fair ventilation.
402	13	4	good	milk house	good	light, dry, fair ventilation.
403	35	0	good	milk house	good	light, dry, well ventilated.
404	25	7	good	milk house	good	light, dry, fair ventilation.
405	22	8	good	milk house	good	light, dry, fair ventilation.
406	55	10	good	milk house	good	light, dry, well ventilated.
407	0	10	fair	milk house	fair.	dark, dry, fair ventilation.
408	31	3	fair.	milk house	good	light, dry, well ventilated.
409	25	0	good	milk house	good	dark, dry, well ventilated.
410	15	0	good	milk house	good	light, dry, well ventilated.
411	10	14	fair	milk house	fair.	dark, dry, well ventilated.
412	35	35	fair.	milk house	fair.	light, damp, well ventilated.
413	0	16	good	milk house	good	dark, dry, fair ventilation.
414	1	28	fair.	milk house	good	light, dry, well ventilated.
415	17	0	good	milk house	good	light, dry, well ventilated.
416	7	7	good	milk house	dirty	dark, damp, poor ventilation.
417	18	1	good	milk house	fair.	dark, dry, fair ventilation.

HOPKINS.

Record No.	Herd. No. Tested.	Herd. No. Not Tested.	Condition of Cattle.	Milk Kept In.	Condition of Stable. Outside.	Condition of Stable. Inside.
418	4	16	excellent.	milk house	good	light, dry, well ventilated.
419	0	0	good		good	light, dry, well ventilated.
420	1	35	good	milk house	good	light, dry, fair ventilation.
421	3	27	good	milk house	good	light, damp, well ventilated.
422	11	20	good	in barn.	good	light, dry, well ventilated.
423	25	16	good	in barn.	good	dark, dry, poor ventilation.

PLYMOUTH TOWNSHIP.

Record No.	Herd. No. Tested.	Herd. No. Not Tested.	Condition of Cattle.	Milk Kept In.	Condition of Stable. Outside.	Condition of Stable. Inside.
424	25	0	poor	milk house	good	dark, damp, fair ventilation.
425	24	0	good	milk house	good	light, dry, fair ventilation.
426	3	31	fair.	milk house	dirty	light, damp, fair ventilation.

GOLDEN VALLEY.

Record No.	Herd. No. Tested.	Herd. No. Not Tested.	Condition of Cattle.	Milk Kept In.	Condition of Stable. Outside.	Condition of Stable. Inside.
427	31	0		milk house	good	light, dry, fair ventilation.
428	27	2	good	milk house	good	light, dry, fair ventilation.
429	28	4	good	milk house	good	light and dry.
430	3	42	good	milk house	good	light, dry, well ventilated.
431	20	20	good	milk house	good	light, fair ventilation.
432	33	6		milk house	good	light, dry.
433	22	3		milk house	good	light, dry, well ventilated.
434	25	0	good	tank.	good	light, dry, well ventilated.
435	22	0		in tank.	good	dark, dry, half ventilated.

INSPECTION OF DAIRIES.—Continued.

GOLDEN VALLEY.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
436	15	16	....	milk house	good	light, dry, well ventilated.
437	16	4	good	tank	good	light, dry, well ventilated.
438	23	17	good	milk house	good	light, dry, fair ventilation.
439	40	8	....	milk house	good	light, dry, well ventilated.
440	8	26	good	milk house	good	light, dry, well ventilated.
441	16	0	....	milk house	good	light, dry, fair ventilation.
442	20	0	....	milk house	good	light, dry, fair ventilation.
443	30	4	good	milk house	fair	light, dry, fair ventilation.
444	15	5	good	milk house	good	light, dry, fair ventilation.
445	22	0	good	in tank	good	dark, dry, fair ventilation.
446	25	5	....	milk house	good	light, dry, fair ventilation.
447	14	4	good	milk house	fair	light, dry, fair ventilation.
448	7	1	good	milk house	good	dark, dry, fair ventilation.
449	18	7	....	milk house	good	light, dry, well ventilated.
450	40	8	....	milk house	good	light, dry, well ventilated.
451	5	9	....	milk house	good	light, dry, fair ventilation.
452	50	48	....	milk house	fair	light, dry, fair ventilation.
453	20	4	....	milk house	good	light, dry, well ventilated.
454	25	25	....	milk house	good	light, dry, well ventilated.
455	9	35	good	milk house	good	light, dry, well ventilated.
456	10	13	good	milk house	....	light, dry, well ventilated.
457	28	3	good	milk house	good	light, dry, fair ventilation.
458	76	1	good	milk house	good	light, dry, well ventilated.
459	25	7	fair	in barn	good	dark, dry, fair ventilation.

MINNETONKA.

Record No.	No. Tested.	No. Not Tested.	Condition of Cattle.	Milk Kept In.	Outside.	Inside.
460	14	2	....	ice box outside	good	light, dry, well ventilated.
461	15	7	....	milk house	fair	light, dry, fair ventilation.
462	0	10	....	milk house	....	light, dry, fair ventilation.
463	0	7	....	milk house	good	....
464	0	11	....	milk house	good	light, dry, fair ventilation.
465	16	6	....	milk house	good	light, dry, well ventilated.
466	21	4	....	milk house	fair	light, dry, well ventilated.
467	30	20	fair	milk house	good	light, dry, well ventilated.
468	20	22	....	milk house	good	light, dry, well ventilated.
469	15	15	good	milk house	good	light, dry, fair ventilation.
470	40	0	good	milk house	good	light, dry, well ventilated.

BROOKLYN.

Record No.	No. Tested.	No. Not Tested.	Condition of Cattle.	Milk Kept In.	Outside.	Inside.
471	50	21	good	milk house	fair	light, dry, fair ventilation.
472	29	4	good	milk house	good	light, dry, good ventilation.
473	19	10	fair	milk house	good	light, damp, poor ventilation.
474	26	0	good	milk house	fair	light, dry, fair ventilation.
475	42	1	good	milk house	fair	dark, damp, fair ventilation.
476	12	0	fair	ice tank	....	dirty, no light, no ventilation.
477	17	2	poor	milk house	good	light, dry, fair ventilation.
478	0	5	good	milk house	good	dark, no ventilation, but dry.

INSPECTION OF DAIRIES.—Continued.

FRIDLEY.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
479	11	15	good	milk house		dark, damp, no ventilation.
480	21	0	excellent	spring house	excellent	light, dry, well ventilated.
481	0	0	poor	milk house		dark, no ventilation.
482	27	3	good	milk house	fair	light, damp, no ventilation.
483	1	29	good	milk house	good	dark, dry, fair ventilation.
484	18	3	fair	milk house	good	dark, dry, fair ventilation.
485	0	9	good	milk house	good	light, dry, fair ventilation.
486	8	9	fair	milk house (dirty)		dark, poor ventilation, damp.
487	20	1	fair	milk house	good	good light, dry, fair ventilat'n
488	40	2	good	milk house	good	light, dry, fair ventilation.
489	16	2	fair	milk house	good	light, dry, poor ventilation.
490	17	10	good	milk house	good	light, dry, ventilat'n stopped.
491	8	6	good	milk house	wet	dark, dry, fair ventilation.
492	23	1	fair	milk house	good	dark, dry, fair ventilation.
493	19	21	fair	in tank	dirty	dark, damp, poor ventilation.
494	16	12	good	milk house	good	dark, dry, fair ventilation.
495	111	42	good	milk house	good	light, dry, fair ventilation.
496	10	6	fair	shed	fair	dark, damp, fair ventilation.
497	0	13	fair	milk house	no drain	dark, damp, poor ventilation.
498	0	12	fair		fair	dark, not well ventilated.
499	4	21			good	dark, damp, fair ventilation.
500	0	19	poor	tank outside	dirty	dark, damp, poor ventilation.

CRYSTAL LAKE TOWNSHIP.

501	14	2	good	milk house	good	dark, dry, no ventilation.
502	0	12	fair	milk house	good	light, dry, well ventilated.
503	3	15	fair	milk house	fair	dirty, damp.
504	18	3	good	milk house		dark, dry, poor ventilation.
505	32	2	good	milk house	good	dark, dry, fair ventilation.
506	32	21	fair	milk house	fair	dark, damp, fair ventilation.
507	35	9	good	milk house	fair	light, damp, fair ventilation.
508	26	1	good	milk house	good	light, dry, fair ventilation.
509	15	2	good	milk house	good	dark, dry, poor ventilation.
510	14	11	fair	milk house	good	dark, damp, fair ventilation.
511	19	16	good	milk house	good	light, dry, good ventilation.
512	16	2	fair	milk house	fair	dry, light, well ventilated.
513	8	16	good	milk house	good	dark, dry, fair ventilation.
514	30	15	good	in barn	good	dark, damp, fair ventilation.
515	20	23	fair	barn (water dirty)	fair	dark, dirty, poor ventilation.
516	20	4	fair	barn	fair	light, dry, poor ventilation.

EDINA.

517	14	0	good	tank outside	good	light, damp, close, no vent.
518	9	2	good	tank outside	good	dark, damp, fair ventilation.
519	25	1	fair	shed	good	light, damp, fair ventilation.
520	7	0	fair	milk house	good	good light, damp, fair vent.
521	0	20	good	out of doors	good	light, dry, fair ventilation.
522	6	24	good	milk house	dirty	light, dry, poor ventilation.
523	15	0	good	milk house	clean	light, dry, fair ventilation.
524	9	2		milk house	clean	light, dry, well ventilated.
525	24	10	fair, (clean)	milk house	good	light, dry, well ventilated.
526	48	3	good	milk house	fair	light, dry, well ventilated.
527	19	9	good		good	light, dry, well ventilated.
528	6	1	fair	milk house	good	light, dry, well ventilated.
529	40	7	good	milk house	good	light, dry, well ventilated.
530	14	6	good	milk house	good	light, dry, well ventilated.
531	4	2	good	milk house	good	light, dry, well ventilated.

INSPECTION OF DAIRIES.—Continued.

EDINA.

Record No.	Herd.		Condition of Cattle.	Milk Kept In.	Condition of Stable.	
	No. Tested.	No. Not Tested.			Outside.	Inside.
532	10	0	good	milk house	good	light, dry, fair ventilation.
533	28	12	good	in barn.	good	light, dry, fair ventilation.
534	20	0	good	milk house	good	light, dry, well ventilated.
535	11	0	good	milk house	good	light, dry, poor ventilation.
536	9	0	good	milk house	dirty	dry, well ventilated.
537	0	29	fair	close to barn	good	light, dry, well ventilated.
538	10	0	good	milk house	good	light, damp, fair ventilation.
539	30	0	fair	in barn	good	light, damp, fair ventilation.
540	8	0	fair	dwelling	excellent	light, damp, fair ventilation.
541	21	12	fair	shed near barn.	fair	light, damp, fair ventilation.
542	24	3	good	tank	good	excellent.

BLOOMINGTON TOWNSHIP.

Record No.	No. Tested.	No. Not Tested.	Condition of Cattle.	Milk Kept In.	Outside.	Inside.
543	16	0	fair	milk house	good	dark, damp, fair ventilation.
544	4	14	fair	milk house	wet	dark, damp, fair ventilation.
545	16	0	good	milk house	good	light, damp, fair ventilation.
546	20	5	good	milk house	good	dark, damp, fair ventilation.
547	0	13	fair	milk house	good	light, damp, fair ventilation.
548	8	4	fair	tank outside	good	dark, dry, fair ventilation.
549	7	0	fair	milk house	good	light, damp, fair ventilation.
550	2	12	fair	milk house	good	light, damp, dirty, fair vent.
551	15	9	good	milk house	good	dark, fair ventilation, damp.
552	8	2	good	milk house	good	light, damp, fair ventilation.
553	14	15	good	milk house	good	light, damp, fair ventilation.
554	0	12	fair	milk house	good	light, dry, fair ventilation.
555	4	14	good	milk house	very good	light, dry, well ventilated.
556	0	8	good	milk house	very good	light, dry, fair ventilation.
557	0	8	good	milk house	good	light, dry, well ventilated.
558	9	1	good	milk house	good	light, dry, well ventilated.
559	8	7	good	milk house	good	light, dry, well ventilated.
560	0	11	....	milk house	....	light, dry, well ventilated.
561	3	12	fair	milk house	good	light, dry, well ventilated.
562	2	4	good	milk house	good	light, dry, well ventilated.
563	1	2	good	milk house	good	light, dry, fair ventilation.
564	2	12	fair	milk house	fair	light, dry, fair ventilation.
565	0	4	good	milk house	good	light, dry, well ventilated.
566	0	5	good	milk house	good	light, dry, well ventilated.
567	8	8	good	milk house	good	light, dry, well ventilated.
568	5	0	fair	milk house	good	light, dry, fair ventilation.
569	4	4	fair	milk house	dry	dark, dry, well ventilated.
570	6	0	fair	milk house	good	light, dry, well ventilated.
571	7	13	good	milk house	good	dark, dry, fair ventilation.
572	0	9	good	milk house	fair	light, dry, fair ventilation,
573	0	12	good	milk house	good	light, dry, fair ventilation.
574	0	5	good	milk house	good	....
575	0	9	good	milk house	good	light, dry, fair ventilation.
576	0	10	good	milk house	fair	light, dry, fair ventilation.
577	20	9	good	milk house	good	light, dry, well ventilated.
578	28	7	very good	barn	good	light, dry, poor ventilation.
579	10	8	fair	milk house	fair	dark, dry, poor ventilation.
580	24	0	clean	barn	fair	dark, dry, poor ventilation.
581	22	0	good	milk house	good	light, dry, fair ventilation.
582	10	15	good	milk house	good	dark, dry, fair ventilation.
583	0	7	....	dwelling	....	light, damp, fair vent., dirty.
584	0	3	fair	dwelling	good	dark, damp, fair ventilation.
585	52	8	fair	tank near barn	dirty	dark, damp, fair ventilation.
586	5	13	....	in barn	fair	light, dry, well ventilated.

The form of blank used in the inspection of dairies reported in part in the preceding table reads as follows:

Date....................

No ....Herd of..

Located at (City, Village or Township)....................................

Breed of cattle...

Bulls: No. tuberculin tested.................. Breed......................

No. not tuberculin tested............... Breed......................

Cows: No. tuberculin tested.........................

No. not tuberculin tested.........................

Calves: No. heifers.................................

No. bulls..................................

No. of cows on hand when herd first tested..................................

No. of cows still on hand from first test...................................

No. of tuberculin tests of herd.................Dates..........................

If cattle tested, number each time: 1st............2nd...........3rd........

No. reacted on first test...................... Date.........................

No. reacted on second test.................. Date...........................

No. killed ....Dates...................................

No. passed as fit for food........................No. condemned.............

No. tested cattle purchased since first testing of herd.........................

Dates ....

No. non-tested cattle purchased since first testing of herd......................

Dates ....

Total number of cows owned since the first testing of herd.....................

No. of tested cows on hand........No. of non-tested cows on hand...........

Condition of cattle (Poor, fair, good, excellent)............................

Character of feed used...

Date of beginning business..

How much milk sold daily..

Where is milk kept...

Surroundings of stable...

Style of stable (photograph)...

Interior condition of stable (Dark, light, damp, dry, well ventilated).......

Style of fastenings for cattle...

Style of stall...

No. of cubic feet per animal (estimated)....................................

Who tested cattle each time...

....

By order of...

(Local board of health, owner, or state board of health.)

Remarks ....

....

....Name and address of Reporter

In the quarterly report for the veterinary department ending June 30, 1902, is the following:

"The people of the Twin Cities are getting all that they are paying for, and few milk consumers are sufficiently interested in knowing the character of their milk supply to make inquiry or to visit the dairy supplying them. Dairymen who are keeping their dairies in the best condition are getting little if any more for their milk than are those who are keeping the poorest dairies.

A summary of the conditions given in the table shows that there are but seven (7) dairies that can be classed as excellent. One hundred and sixty-four (164) as good. One hundred and eighty-six (186) as fair. With two hundred and twenty-nine (229) classed as unsatisfactory. Milk was kept in:

Dirty milk houses	9
Sheds	30
Outside tanks	42
Cistern	1
Barn	28
Dwelling house or cellar	36

Considering the unsanitary conditions of many of the stables it is unfortunate that the conditions should be made still more objectionable through the place where the milk is kept. Cows kept under unsanitary conditions might possibly produce milk which would not be the direct cause of sickness, provided the milk was properly handled and kept free from contamination. It is, however, almost, if not quite, impossible to keep milk in a dirty milk house, barn, shed, cistern or dwelling house without its contamination.

Early in 1902 there was much discontent from country districts near Minneapolis, relative to the Minneapolis testing. Many of the town boards said they were willing to have the dairy cattle within their jurisdiction tested, but were not willing that this should be done by the Minneapolis authorities. The Minneapolis veterinarian announced in the Spring of 1902, that he would recognize no test in that city, but their own. Other townships said they were willing to have their dairy cows within their jurisdiction tested *provided* some means was taken to prevent the purchase of non-tested cows to take the place of the condemned cows.

On June 22, 1902, a conference was held at the office of the State Board of Health at which Drs. Keyes of Minneapolis, Kirby and Pomeroy of St. Paul and Brimhall (veterinarians) also Dr. P. M. Hall, commissioner of health, Minneapolis, and Dr. Bracken were present. Dr. Ohage was unable to attend.

The following propositions for the State Board of Health were submitted: "While we endorse the tuberculin test as a means of recognizing the presence of bovine tuberculosis, we do not consider the present methods employed in St. Paul and Minneapolis, viz.: the testing of cattle; the condemning of those which react to the tuberculin test; the removal of such condemned animals from the herd; the purchase of other animals to take the place of those condemned, such animals not having been submitted to the tuberculin test; the continued use for dairy purposes of such untested animals for an indefinite period;—as tending to secure a non-tuberculous milk supply. We therefore suggest the acceptance of one of the following propositions:

(1) That the compulsory testing of dairy herds be continued only on condition that some means be provided by which dairymen can replenish their herds with tuberculin tested cattle;

That no dairyman be permitted to sell milk, in either city, from a herd containing any untested cows;

That attention be given to the disinfection of dairy barns from which condemned animals have been removed;

That proper attention be given to the ventilation and general sanitation of dairy barns and the places in which milk is stored;

That sufficient inspection be made of these places to secure a permanent improvement of dairy barns and milk supplies.

(The table preceding seems to indicate the need of such propositions as the above.)

(2) That if the above plan is not feasible, the testing of dairy herds with tuberculin be discontinued until such time as it can be adopted, recognizing as a reason for the discontinuance of such testing the fact that the present method is unsatisfactory and is not yielding the results claimed for it.

(3) That if the cities are not ready to accept either of the foregoing propositions the State Board of Health be permitted to withdraw from such unsatisfactory work, leaving the cities to deal directly with adjoining local boards of health (town boards of supervisors).

Dr. Ohage not being present no action could be taken for St. Paul, but Dr. Hall and Dr. Keyes both expressed themselves as not ready to accept the first or second proposition for Minneapolis, but quite willing to follow the third. The conference adjourned with this understanding.

Following this came the Mounds View township case where the Minneapolis authorities tried to compel the State Board of Health to enforce the slaughter of animals which had been condemned by the city veterinarians outside of their jurisdiction. The State Board of Health was governed in its action by the advice of Attorney General Douglas, which was to the effect that the Minneapolis sanitary authorities might exclude any dairyman's milk from their city, but had no right outside of the city limits to condemn cattle for which the township and state had to pay. This opinion was sustained by Judge Brooks.

The following statement shows the amount of money paid out by the state as its one-third of cattle killed after inspection for tuberculosis. Also the amount paid appraisers.

A statement of Expenditures from the Infectious Diseases of Animals' Fund for Reimbursements for Cattle Killed for Tuberculosis and for Appraisers' Fees:

	Appraised Tuberculous Cattle.	Service of Appraisers.
May, 1901	$162.52	....
June, 1901	622.36	$103.00
July, 1901	675.01	62.00
Totals	$1,459.89	$165.00
August, 1901	255.63	80.00
September, 1901	254.76	41.00
October, 1901	664.45	25.00
November, 1901	208.26	19.00
December, 1901	200.15	15.00
January, 1902	359.82	11.00
February, 1902	60.53	4.00
March, 1902	341.57	18.00
April, 1902	310.10	8.00
May, 1902	333.09	19.00
June, 1902	614.95	12.00
July, 1902	194.85	10.00
Totals	$3,798.16	$262.00

August, 1902	625.89	6.00
September, 1902	264.55	20.00
October, 1902	734.41	154.00
November, 1902	226.04	12.00
December, 1902	92.27	....
January, 1903	520.89	10.00
February, 1903	366.89	13.00
March, 1903	251.21	12.00
April, 1903	256.65	8.00
Totals	$3,338.80	$235.00
Grand total	$8,596.85	$662.00

In connection with the testing of cattle it was necessary to establish certain regulations and records. Some of these are found in the eighteenth biennial report of the Minnesota State Board of Health. Pages 316-319.

The following circular of information relating to bovine tuberculosis was issued under date of Aug. 1, 1901, for the use of local health officers:

> The law now provides that whenever an animal has been adjudged infected with the disease of tuberculosis and has been ordered killed by the state or local board of health, such animal shall be appraised at a valuation not to exceed $40. The value of the hide and carcass is to be deducted from the amount of appraisal, and the balance is to be paid for, one-third by the state, one-third by the local board, and the remaining one-third shall be borne by the owner.
>
> All cases of suspected tuberculosis must be promptly reported to the State Board of Health on blanks provided for that purpose.
>
> The State Board of Health shall be duly notified before any cattle are ordered killed on account of tuberculosis.
>
> All cattle for dairy or breeding purposes brought into this state must be accompanied by a health certificate from a veterinarian, whose competency and reliability are certified to by the authority charged with the control of the diseases of domestic animals in the state from which the cattle are shipped. Said health certificate must show that the cattle have been examined and tested with tuberculin, and are free from any contagious disease.
>
> It shall also contain the owner's statement that the cattle have not been exposed to anthrax, blackleg, actinomycosis, malignant catarrh, or Texas fever during the preceding three months. Compensation is not allowed for cattle slaughtered on account of tuberculosis, which have not been owned in the state at least one year prior to the date of slaughter.
>
> Milk from creameries should be boiled before use for feeding purposes.
>
> Local health officers of towns, villages and cities of Minnesota are hereby

authorized and instructed to seize and hold in quarantine all cattle for dairy or breeding purposes coming into this state without a legal permit or proper health certificate, and to notify the State Board of Health at once of such action. The law provides that whenever any animal is quarantined in transit the expense of quarantine shall be borne by its owner or keeper.

Note.—Your attention is especially called to the rules and regulations of the Minnesota State Board of Health, for the prevention of the importation of diseased animals into Minnesota. These rules and regulations require that Range horses, cattle for dairy or breeding purposes, and hogs or sheep for breeding purposes shipped into Minnesota must be accompanied by a health certificate satisfactory to this board.

S. D. BRIMHALL, V. M. D.,
Director Veterinary Department.

In carrying out the law of 1901, which provided compensation to owners for cattle slaughtered because of tuberculosis, it was necessary to have a record of appraisal, etc. The following record sheet was prepared and put into use.

APPRAISAL OF ANIMAL.

We have this day examined a (Insert description of animal)...........
Tag No.......quarantined for tuberculosis in the (city or town)............
of .... and hereby appraise its value at $.......
The animal has been in the state...
Dated ...., 190....

...........................residing at ....
.... " " ....
.... " " ....

Appraisers.

DESCRIPTION AND REPORT OF ANIMAL SLAUGHTERED.

Description of animal.............................Tag No..............
Date of first test.....Date of state quarantine.....Date of second test.....
Owner's name and address..
Killed at (Slaughter house or private premises)..........................
Lesions: Lungs ....Pleura ....Liver ....

Postpharyngeal ....
Bronchial ....
Lymphatics:
Mediastinal ....
Mesenteric ....
Mammary ....

Disposed of as follows..
Weight ....
Carcass:
Amount received ....
Weight ....
Hide:
Amount received ....
Remarks ....
....

....................Inspector.

When cattle were appraised and killed it was necessary for the sanitary authority doing the killing to furnish a certified copy of appraisal and description of the animal to the second sanitary authority held legally responsible for its third of the appraised value of the animal (city, village, or township superintending the killing to furnish certified copy to the state or vice versa)—hence the following on the reverse side of the appraisal blank given above.

STATE OF MINNESOTA,
ss:
County of..............

I hereby certify that I have carefully compared the foregoing appraisal of animal and report of its slaughter with the original written appraisal of said animal, and the original written report of its slaughter, on file and of record in the office of the .... Board of Health, and that they are true and correct copies of said original appraisal and of the said original report of slaughter.

Witness my hand this ....day of................, 190...

....
Secretary of the .... Board of Health.

The testing of dairy cattle with tuberculin has been encouraged throughout the state. Dairymen and stockmen have been urged to recognize the importance of protecting their herds from tuberculosis. For this missionary work the following form was prepared and used.

REQUEST FOR INSPECTION AND TUBERCULIN TEST OF HERD, AT THE EXPENSE OF THE MINNESOTA STATE BOARD OF HEALTH.

..................................1903.

To the Minnesota State Board of Health, St. Paul,

Gentlemen: I have reason to believe that some of my cattle are afflicted with tuberculosis, and I wish to have my entire herd inspected and tested with tuberculin, if such test is deemed necessary by your representative, and the diseased animals disposed of according to the rules and regulations of the State Board of Health.

I understand that the first inspection and test will be made at the expense of the state, and in consideration thereof I agree to employ the means recommended by your board to prevent the re-introduction and development of tuberculosis in my herd. To this end I agree to kill all animals which give positive reaction to the test, to thoroughly disinfect the stable, and to purchase only cattle which have been proven free from tuberculosis as shown by examination and test made by a veterinarian recognized by your board.

Very truly,

....

Address....................................

Township.................. County..................

My herd includes the following animals: Cows ...., heifers over one year old......................., bulls over one year old ...., steers...................... The milk from this herd is used by................................ for.......................

The cattle are (State breed and whether registered)........................

The following are my reasons for believing that some of my herd are afflicted with tuberculosis: ....

Requests, as provided for in the above form, have come from breeders of common rather than of pure bred cattle. The latter in many instances hesitating to subject their animals to such a test; fearing financial injury. Whenever a majority of the breeders of common cattle have become interested in maintaining healthy herds their influence will be felt among the breeders of pure bloods.

There are already a few pure pure bred herds maintained under the tuberculin test, and the number of buyers of pure bred cattle who demand the protection of the tuberculin test as a condition of purchase, is on the increase.

Cattle have been tested in the following counties: Anoka, Dakota, Faribault, Hennepin, Le Sueur, Mower, Polk, Ramsey, Redwood, Sibley, Steele, Waseca, Washington and Wright.

Cattle were tested in Anoka, Dakota, Hennepin, Ramsey and Washington counties because of compulsion through St. Paul and Minneapolis. The other tests were demanded by local boards of health in districts supplied from the dairies, or were voluntary. The history of some of the tested herds is interesting. In one instance a herd of high grade cattle was tested by a local veterinarian with many reactions following. Inquiry brought out information from the owner that he had known of the presence of tuberculosis in his herd for two years (of course during this period he had been selling infected animals, and thus spreading the disease, to probably non-infected herds). The loss from death was becoming so heavy in his herd that he decided to take advantage of the law, which provided compensation for tuberculous animals slaughtered, thus protecting himself against the total loss of his herd.

The testing of a herd in one case was brought about in such a peculiar way that it is worthy of record. A medical health officer noticed some meat hanging in a butcher's shop, which had a suspicious appearance. He sent a portion of this meat to the State Board of Health laboratory from which in due time he received a report that the meat was tuberculous. The health officer thereupon inquired of the butcher where he obtained the tuberculous animal, and was referred to a certain herd, the owner of which was not only willing but anxious to have his cattle tested. The result of the test showed twenty-six infected animals out of a herd of thirty-four.

In another instance cattle in a herd began dying. The owner, in conversation with Dr. Annand described their condition. Dr. A. suggested that the cattle probably had tuberculosis. At the request of the owner he made a post-mortem on a cow that had died a few days previously. The lesions of tuberculosis were present to quite a marked degree. A test of the herd was thereupon advised and made by Dr. A. with the result that eight out of a herd of twenty-six reacted, and were slaughtered.

In another instance Dr. Annand when on a trip of inspection was asked by a farmer to see a pure bred cow that he had recently purchased at a sale of pure breds in Iowa. Dr. A. informed him that the cow had tuberculosis, and advised the testing of the herd. The farmer followed this advice. Of forty-one animals tested, three reacted, two of which came from the sale above referred to. The third animal had been on the place for a considerable period. She had been closely associated, however, with the newly purchased cows for a little over two months (post-mortem of this case showed but a few primary lesions). The farmer thereupon began legal action against the breeder who sold the two infected cows, but the case was settled out of court.

Dr. A. found two other pure bred cows sold at this same sale to another farmer in the same Minnesota county that were diseased. This man also began action against the breeder who sold him the cows.

In another instance a farmer noticed that one of his cows was ill. He wrote to the state board for advice. It was suggested to him that in all probability she had tuberculosis. He thereupon requested a test of his herd. This was made with the result that this cow only, in a herd of five, had tuberculosis. He had bought her of a neighbor. The other four had been raised on his own place.

In another instance when a farmer noted that some of his cows were not healthy, a test was made with the result that eight out of thirteen reacted and were slaughtered.

In still another case in the country where a request was made for a test thirty-eight out of fifty-three animals reacted and were slaughtered.

In another instance a local veterinarian tested the herd of a farmer upon the owner's request and found every animal diseased. In this case the farmer traced the source of infection to a cow purchased at a sale, which died of tuberculosis. These few illustrations point out the importance of stockmen and farmers protecting their herds from tuberculosis by the wise use of the tuberculin test. The following table gives some idea of the cattle tested from Oct. 1, 1901, to April 23, 1903. It should be noted that the use of the test outside of the twin cities was steadily on the increase.

TUBERCULIN TEST RECORD NO. 1.

Period.	Cattle Tested.	Cattle Killed.	Cattle In quarantine.
Oct. 1, 1901	.....	....	59
Oct. 1 to Dec. 31, 1901	3,060	123	....
Oct. 31, 1901	....	....	85
Dec. 31, 1901, to March 31, 1902	3,024	90	....
March 31, 1902	.....	....	144
March 31 to June 30, 1902	2,578	147	....
June 30, 1902	.....	....	187
June 30 to Sept. 30, 1902—			
St. Paul	15	175	....
Minneapolis, July, August	*868		
State at large	220		
Sept. 30 to Dec. 31, 1902—			
St. Paul	918	93	....
Minneapolis, October	*954		
State at large	418		
Dec. 31, 1902, to April 23, 1903	*1,250	....	....

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*Records for quarter incomplete.

The records of the tuberculin test for 1901 and 1902 are shown in the following table:

TUBERCULIN TEST RECORD NO. 2.

	1901.	1902.
Number of cattle tested	9,982	9,292
Number reacted	458	719
Number killed	315	471
Number retested	216	178
Number reacted on retest	157	83
Total number killed during the year	469	483

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The records of testing and killing during a period of over four years is given below:

TUBERCULIN TEST RECORD NO. 3.

	1899.	1900.	1901.	1902.	1903 to April 21.
Number tested....	5,725	7,405	9,982	9,292	1,250*
Number killed.....	62	185	469	483	193*

---

*Minneapolis records incomplete.

Laboratory Investigations. In addition to the above described routine work of the board in handling tuberculosis in cattle in this state, the following special investigations have been made:

(1) *Hugo, Washington County*—May 29, 1901, there was received in the laboratory a package containing a large suppurating gland from a cow. The specimen had been sent by Mrs. A. G. W. of Hugo, Minn. The animal had been sick for several weeks before being killed and was greatly emaciated. Examination of the carcass by the hired man revealed only this large supperating gland near the trachea.

Direct coverslip preparations of sections of the tissue were stained for tubercle bacilli, but none were found. The tissue itself was non-tuberculous.

(2) *Kellogg, Wabasha County*—Aug. 5, 1901, there was received in the laboratory a nodule about .5 c.c. in diameter from Dr. Annand. The gland had been removed August 3d, at 10 a. m., from the colon wall of a two months' old pig, killed for the purpose of autopsy when very sick of supposed tuberculosis. The pig was the property of Mr. A., near Kellogg, Minn., and was one of several exhibiting symptoms of tuberculosis after having been fed for some weeks on the milk of cows (shorthorns) which were probably tuberculous. The specimen was placed in 10 per cent formalin at 2 p. m., Aug. 5, 1901, and hardening completed in 96 per cent alcohol. Specimen imbedded in parrafin, cut, stained with hæmatoxylon and eosin, carbol fuchsin and methylene blue and examined Aug. 13, 1901. Specimens stained with hæmatoxylon and eosin showed a cheesy, amorphous mass in the center, surrounded by small round cells, which in turn were enclosed in fibrous walls. At one side the villi of the intestines were seen. The intestinal wall at this point was infiltrated throughout with small round cells. Decomposition changes had evidently occurred between the removal of the specimen and its fixation.

Specimens stained with carbol-fuchsin and methylene blue gave a few solitary and one group of three tubercle bacilli. Those seen were mostly within the vicinity of the intestinal wall, near the villi. The specimen was apparently a large, much degenerated tuberculous nodule of the intestinal wall.

(3) *Waseca, Waseca County*—On Nov. 22, 1901, there was received from the Secretary of the State Board of Health two oval pieces of tissue about 1¼ inches in diameter and of a yellowish red appearance. These were said to be glands removed from a supposedly tuberculosis cow belonging to Mr. A. E., Waseca, Minn., and forwarded by Dr. J. F. Lynn, of Waseca. They consisted of a firm fibrous capsule containing a soft, cheesy material in which were small pieces of lime. The cut surface had the same yellowish red color as the capsule.

Microscopic Examination: Stained preparations made directly from the material showed no evidence of *B. tuberculosis*, and cell structure could not be made out. Bacteria of various appearances were present. Cultures made from the centers of the masses showed many large bacilli of varying lengths, probably putrefactive and also *B. pyocyaneus*.

Animal Inoculations: Guinea pig No. 466, weight 525 grammes, was inoculated intraperitoneally with .5 c. c. of broth emulsion of the center of gland. It began to lose weight shortly after inoculation and died January 7th, i. e., 46 days after inoculation. At the site of inoculation in the abdominal wall was an ulcer with indurated edges and a curdy, cheesy material at its base. In this cheesy material tubercle bacilli were demonstrated microscopically. The tissues of the guinea pig showed minute tubercles throughout.

Guinea pig No. 467, weight 545 grammes, was inoculated subcutaneously in the right groin at the same time and in like manner as guinea pig No. 466. This animal steadily lost weight, developed a tuberculous ulcer at the site of inoculation, showed swelling and induration of the glands of the groin and was found dead on January 13th, i. e., 52 days after inoculation. Autopsy showed generalized tuberculosis.

This shows conclusively the presence of *B. tuberculosis* in the material from which the guinea pigs were inoculated. That they were probably few in number was indicated by the failure to demonstrate them microscopically in the smears made directly from the tissue and by the fact that the guinea pigs succumbed to tuberculosis only after a prolonged delay.

(4) *Grafton, N. D.*—Saturday, Dec. 7, 1901, there was received in the laboratory from Mr. F. of Grafton, N. D., a portion of lung and liver from an animal. These were wrapped in a newspaper and placed in a cigar box. Accompanying the specimen was the following letter:

> I send you some pieces of tissue for examination. They were taken from a cow that died a few days ago. The cow seemed in good order and gave birth to her first calf when all at once she began to get poorer and poorer until she finally died. This is the third one that has died in the same way this spring. I also have another that seems to be affected in the same manner. They seem to have a good appetite but do not seem to pick up any when they start to get poor. When one feels of the hide and presses against the flesh it seems as though the flesh about was lifeless. I have also a yearling that looks as though she was gradually beginning to fail. The small piece I send was cut off from the lung. All the parts had the disagreeeable odor that this has. One would think that the animal had been dead a long time by the smell of the lungs just after she died.
>
> Yours truly,
>
> G. W. F.

The tissues consisted of a portion of the liver and portion of lung. The liver contained a large cheesy mass of granular material of a yellowish color. The lung was studded with small calcareous masses. Both pieces of tissue were badly decomposed and unfit for use. Direct coverslip preparations were stained for tubercle bacilli. No tubercle bacilli were found. A culture taken from the lung showed a white staphyloccus. There was no growth obtained from the liver.

(5) *State Experiment Station, Ramsey County*—May 23, 1902, Drs. Brimhall, Reynolds and Lyford made an autopsy at the State Experiment Station on a Tamworth boar, aged about four years, which died after a few days' illness. Post-mortem examination showed a marked pneumonia with tubercles of the pleura and pericardium; also an apparently tuberculous growth on the vertebræ in the region of the first dorsals. This growth extended into the interior of the vertebral column and pressed upon the spinal cord. Portions of the growth and portions of the tissues and bronchial lympathatics were brought to the laboratory.

Direct coverslip preparations of sections of the tissue stained with carbol-fuchsin and methylene blue showed no tubercle bacilli. The tissue was non-tuberculous in histological appearances.

Guinea pig No. 538, weight 280 grammes, was inoculated May 23, 1902, intraperitoneally with 4 c. c. of the emulsion from the mediastinal gland noted above. The animal was found dead on the morning of June 25th, from mixed infection. It was thus impossible to determine by the laboratory examination the presence or absence of tubercle bacilli.

(6) *Triumph, Martin County*—Aug. 8, 1902, Dr. E. L. Blackmun of Triumph, Minn.. sent to the laboratory a specimen of a cow's lung, and accompanied by the following letter:

> I have sent by express today parts of the lung of a cow which has recently died. Tuberculosis supposed to be the cause of death. Being chairman of the board of health there people have come to me objecting to the farmer (who owns the herd in which the cow died) selling beef, butter or milk from the herd.
>
> E. L. BLACKMUN.

The specimen, when received in the laboratory, was found to be poorly preserved in Mueller's fluid. It was, therefore, unsuitable for other than histological examination and was too poorly preserved to admit of a satisfactory examination even of the histology. The matter of examination of the herd was referred to the director of the Veterinary Department, who communicated with Dr. Blackmun concerning the matter, but received no reply.

(7) *Waseca, Waseca County*—March 28, 1903, Dr. J. F. Lynn, H. O., of Waseca, Minn., sent to the laboratory a specimen of supposedly tuberculous individuals taken from the thoracic cavity of a cow. The specimen was accompanied by the following letter:

> I am sending you by mail today some diseased tissue in the form of granules taken from the thoracic cavity of a cow killed for the purpose of being sold as beef. These nodules were closely adhering to the inner surfaces of the ribs and surrounding organs of the chest cavity. There were hundreds of them varying in size from a pea to a pigeon's egg. In all appearances the case is somewhat as the one reported by me Nov. 22, 1901, and examined by you at that time and pronounced tuberculosis. I have therefore condemned this meat, but for the satisfaction of the owner will be very glad if you will give me as early report as possible of your examination.
>
> J. F. LYNN, H. O.

An examination of the specimens showed them to consist of a mass of tuberculous tissue, and a report of the diagnosis was forwarded to Dr. Lynn.

Summary.—The very general employment of the tuberculin reaction renders laboratory work usually unnecessary in the routine diagnosis and control of tuberculosis in cattle. This does not mean that there is not a great deal of pathological and bacteriological work still to be done in connection with this very widespread disease, which is so important from a public health and commercial standpoint.

America has been the foremost of all the nations in recent investigations bearing upon the possible transmission of this disease from animals to man, and the work of Ravenal, Pearson and de Schweinitz would seem to indicate, beyond all doubt, that typical tuberculosis may be produced in cattle, monkeys and various other animals, as well by the tubercle bacillus from human sources as by those of bovine origin. This work is so well covered by these other observers that there seemed little necessity for paralleling it in Minnesota, particularly as so many problems which seemed to be of more local significance were continually being unearthed.

The few desultory examinations have not been without interest, however, and tuberculosis has been shown present by the laboratory in both cattle and swine. The investigation of the material forwarded from the meat carcass exposed for sale, mentioned above, and the subsequent attention to the heard from which the animal came, based upon the laboratory report, is a sufficient argument for the desirability of a laboratory which can be consulted in the work of investigation and control of infectious diseases of animals, more particularly those to which man is also susceptible.

The demonstration by the laboratory of tuberculosis in swine which had been fed, presumably, tuberculous milk, raises the question as to the necessity for laboratory investigation of skim milk from creameries, so largely used for feeding calves and swine. There seems to be good reason for believing that the recent serious increase in tuberculosis in swine in this and adjoining states, as met with by government inspectors, is due largely to this method of feeding. Certainly so serious a menace to the swine raising industry demands a careful investigation by both clinical and laboratory methods, especially since the question involved has an important bearing upon human food products (pork, milk, butter, etc.).

GLANDERS.

When the duties of a director fell upon Dr. S. D. Brimhall, August, 1900, there were then in quarantine in the state eighty-one (81) horses that had been tested with and reacted to mallein, but which showed no clinical symptoms of the disease. Some of these horses had been tested first early in 1898. The rules then in forc required the testing of all animals that had been exposed force required the testing of all animals that had been exposed to glanders. (See page 306, eighteenth report Minnesota State Board of Health.)

These rules were not considered practical, and were changed at the board meeting Jan. 15, 1901, to read as follows:

1. In all ordinary cases of suspected glanders-farcy, first quarantine the suspected animals, then call a competent veterinarian, who shall make such examination and tests as he may deem necessary. The further action of the board shall be largely determined by diagnosis and advice of the veterinarian.

2. All horses, mules or donkeys that are discharging from the nose, or that have had recent sores upon the body, and all animals that have worked as mates with such infected animal must be included in this preliminary quarantine.

3. After Feb. 1, 1901, all horses, mules or donkeys which show positive symptoms of glanders, with or without mallein reaction, must be destroyed without delay.

4. After Feb. 1, 1901, all exposed animals which give one clear reaction to the mallein test, or which show any of the recognized external symptoms of glanders, must be destroyed.

5. All exposed horses, mules or donkeys not showing clinical symptoms of glanders must be placed in quarantine for a period of six months without the mallein test. General use of such animals may be permitted, but they must not be sold, traded or given away during the quarantine period. The quarantined animal or animals must not be fed or watered at any public feeding or watering place.

Provided however, that if at any time the owner presents to the State Board of Health a certificate of a veterinarian showing that an animal so quarantined has been subjected to the mallein test by a veterinarian, approved by the State Board of Health, and that such veterinarian has failed to detect the presence of such disease, then said board may remove the quarantine; and provided further, that in case upon such test such veterinarian certifies that such animal is affected by such disease, then such animal shall be killed forthwith by the Local Board of Health.

Quarantined horses, mules or donkeys shall be inspected by a competent veterinarian, under the supervision of the State Board of Health, once in three months.

Quarantine must not be released in any case until the owner has disinfected the premises as directed by health officers.

In all cases where retests are made, the second dose must be one-half larger than the first.

Carcasses must be destroyed by burning, if practical, otherwise buried under four feet of earth.

The first set of rules required the testing of all horses that had been exposed to glanders. The ones just quoted did not call for the testing of all exposed animals, but did require that those which showed no clinical evidences of the disease should be placed under quarantine for a period of six months, if not tested. Even this quarantine period, if thought advisable, might be extended. The use of animals under quarantine was permitted with certain precautions.

Under the first rules, animals reacting to the mallein test, were placed under quarantine without exhibiting any clinical symptoms of the disease. (Some of these animals are still under quarantine, although to all appearances perfectly healthy.)

The following list shows the number of horses killed on account of glanders in each county by years:

1901.

Wadena 3, Marshall 3, Carlton 2, Hubbard 14, Cass 4, Swift 3, Becker 6, Clay 6, Red Lake 10, Roseau 3, Hennepin 85, Renville 7, Polk 25, Morrison 1, Lac qui Parle 2, Wilkin 1, Rice 3, Ramsey 40, Aitkin 2, St. Louis 24, Lincoln 11, Watonwan 1, Washington 6, McLeod 2, Blue Earth 5, Rock 2, Cottonwood 1, Anoka 27, Freeborn 1, Redwood 5, Pine 3, Big Stone 1, Traverse 5, Dakota 1.

1902.

Blue Earth 1, Becker 6, Benton 3, Carver 1, Cass 2, Clay 2, Chippewa 2, Chisago 1, Dakota 2, Douglas 3, Hennepin,* 6, Hubbard 1, Jackson 3, Kittson 19, Otter Tail 7, Marshall 4, Mower 4, Murray 1, Nicollet 2, Nobles 1, Polk 20, Ramsey 39, Red Lake 1, Redwood 8, Renville 2, Rice 1, St. Louis 8, Steele 9, Swift 6, Todd 1, Traverse 1, Wilkin 2, Washington 5, Wadena 3.

1903.

Washington 9, Kittson 3, Marshall 4, Ramsey 18, St. Louis 1, Becker 1, Hennepin,* 1, Carlton 5, Lyon 2, Itasca 6, Dakota 1, Beltrami 1, Le Sueur 1, Murray 1.

The following table shows the number of horses tested and killed from Jan. 1, 1897, to April 21, 1903:

	1897.	1898.	1899.	1900.	1901.	1902.*	1903* to April 21st.
Number tested...	391	381	490	474	500	191	83
Number killed....	180	165	168	122	315	177	54

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*Note.—Records for Hennepin county incomplete.

Formerly there was no compensation rendered to owners of glandered horses, and this fact was at times the cause of great distress to the poor. This was especially true in the country districts where at times it has happened that a farmer had all of his horses slaughtered on account of glanders in the midst of his busy season, at the same time leaving him without means to buy others. These hardships will no longer be possible since the passage of the Krostue bill. (See page 17.)

Three cases of glanders among human beings have recently occurred in this state. These will be fully reported upon in the nineteenth and twentieth reports of the State Board of Health. Stated briefly they were as follows: Early in 1901 a health officer in the northern part of the state telephoned to the secretary of the State Board of Health that he had a young man with a very peculiar eruption, suggesting even the possibility of smallpox. This latter disease was excluded. In a few days the young man died. Soon after a brother of this patient was taken ill with similar symptoms. He, too, died. Material was taken from this second patient and sent to the State Board of Health laboratory for examination with the result that the disease was shown to have been glanders. The laboratory worker who had charge of this investigation accidentally became inoculated and has now been ill with glanders for a year with a fair prospect of complete recovery.

Examination demonstrated the fact that the first patient received his infection from his own horses that were suffering from glanders. The second patient may have had his infection either from his brother's horses or from his brother, for he took care of him during his illness.

The State Board of Health, realizing the danger from the importation of animals, passed the following regulations October, 1901:

The importation into the State of Minnesota of range horses, cattle for dairy or breeding purposes, hogs or sheep for breeding purposes, is hereby prohibited, except in compliance with the following rules and regulations:

1. Range horses, cattle for dairy or breeding purposes and hogs or sheep for breeding purposes must be accompanied by a health certificate. Said health certificate shall not be accepted by the state or local boards of health, except when signed by the owner of the animals described in the certificate, and containing his statement to the effect that the described animals have not been exposed to any contagious or infectious disease during the three months prior to the date of certificate. The health certificate shall also contain satisfactory proof that the said animals have been properly inspected, and in case of cattle for dairy or breeding purposes it shall also contain

satisfactory evidence of their having been subjected to the tuberculin test, and that each and every animal is free from disease.

The inspections and tests must be made by a graduate veterinarian, whose reliability is vouched for by the authority charged with the control of infectious diseases of animals in the state or territory from which the animals come.

2. Local health officers of towns, villages and cities of Minnesota are hereby authorized and instructed to seize and hold in quarantine all live stock as designated in Sec. 1, coming into this state without a legal permit or satisfactory health certificate, and to notify this board, at once, of such action.

3. All animals found in the State of Minnesota, in violation of this order, must be held in quarantine until they can be properly examined by a veterinarian under the authority of the State Board of Health. The expense of quarantine and examination must be paid by the owner or agent of the quarantined animals, as prescribed by law.

It shall be the duty of all persons, corporations and companies to give due and full notice to the State Board of Health of Minnesota, preceding the arrival at the boundary line of Minnesota, of all live stock which come within the provisions of these rules and regulations.

Note.—Blank forms for making out health certificates will be furnished by this board on application.

Sec. 6805, General Statutes of Minnesota, 1894:

Whoever, being the owner, or having the charge of any animal, knowing the same to have any infectious or contagious disease, or to have been recently exposed thereto, sells or barters the same, or knowingly permits such animal to run at large, or knowing such animal to be diseased as aforesaid knowingly permits the same to come into contact with any other animal, or another person, without his knowledge and permission, shall be fined not more than one hundred nor less than twenty dollars, or imprisoned not more than thirty days.

It will be seen that these bear upon the importation of horses, especially from the western ranges. The following health certificate was therefore required of those shipping range horses into Minnesota:

HEALTH CERTIFICATE FOR RANGE HORSES.

Date...............

This is to certify that on the above date I examined (number)........... range horses, the property of Mr.................. shipped in car No......., and found them free from all evidence of contagious or infectious disease.

....
(Signature of Veterinarian.)

....
(Address.)

OWNER'S STATEMENT.

I do hereby certify that the above mentioned horses have been in my possession for ...., and they have not to my knowledge been exposed to any contagious or infectious disease during the past three months.

....
(Signature of Owner.)

....
(Address.)

Laboratory Investigations.—Laboratory work in this disease has not been extensive, because usually a diagnosis is not a difficult matter for a skilled veterinarian. As a rule investigations have been undertaken only at the instigation of the Veterinary Department of this board in cases where some peculiar manifestation of the disease was encountered or for a verification of the mallein reaction. The mallein test is very generally employed and its accuracy is such that, in connection with clinical observation and autopsy demonstration, laboratory investigation is rarely necessary for a diagnosis of glanders in animals.

The laboratory method (Strauss) usually employed where there is reason to suspect that bacillus mallei is present in fluids or tissues, is to make an emulsion of the suspected material in sterile broth and inoculate it into the peritoneum of male guinea pigs. In these animals the testicles swell up in three or four days, if the glanders bacillus be present in the material used for inoculation, and it may usually be obtained in pure culture from the pus which fills the tunica vaginalis. This permits of the ready isolation of the bacillus when it is mixed with other micro-organisms in such materials as nasal discharge, pus or other exudates. Even where the material to be examined is such that it is possible to obtain the bacillus in purity in cultures made directly from it, for the identification of the micro-organism intraperitoneal inoculation of the male guinea pig is necessary.

The comparison of the accuracy of the laboratory and mallein tests made by Frothingham* in collaboration with the laboratory of the Boston City Board of Health shows the possibility of a small percentage of error in both, neither of which is of particular moment if careful clinical and post-mortem observations be carried on. It seemed undesirable to attempt to formulate methods for routine laboratory examinations for the diagnosis of this disease in Minnesota, owing to the great danger to the health of men and animals involved in the transportation of suspected materials and because of the accuracy of the mallein reaction and the fear that a loss of confidence in that reaction might be suggested by laying stress upon laboratory examination. The glanders bacillus has proven so dangerous to laboratory workers that some hesitation is felt in permitting investigation upon the micro-organism by the heads of certain laboratories.

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*Journal of Medical Research, Vol. VI., p 331.

The laboratory work of this board, although somewhat limited, has proven interesting. The earlier investigations (see pp. 131, 144, 164, 169 and 449, Biennial Report, 1897-98, and p. 452, Report 1899-1900) consisted largely of the examination of tissues, exudates and pus from horses or mules in which there was some unusual manifestation of the disease or some obscure point to be made clear. In one case an investigation to determine the possibility of hens acting as carriers of infection was requested. No data or material was forthcoming, however, which seemed to show a sufficient reason for the investigation. Notwithstanding the extreme susceptibility of bacillus mallei to germicides and other deleterious influences, in one instance (see above for reference) a portion of glandered horse's lung preserved in glycerine was shown to contain living virulent bacilli by cultures and animal inoculation made in the laboratory after its receipt.

Since the beginning of 1901 in connection with the field work carried on by this board (see preceding tables) the necessity or desirability of laboratory investigation has rarely arisen. Plans had been made and some material collected for the investigation of the chronicity of glanders in this state and the testing for the presence of living glanders bacilli in old lesions, especially in the lungs, for the purpose of comparison with the tuberculous processes in cattle. It was not possible to push this work forward, owing to other investigations for which there was more pressing necessity.

Amongst the examinations made may be mentioned the demonstration of glanders bacilli in pus forwarded by mail to the laboratory. After the lapse of several days, from the vial containing the putrid pus which had been collected without any special precautions as to asepsis, virulent glanders bacilli were obtained. Clinical observation and the mallein test would have yielded just as accurate results and the safety of the mails need not have been jeopardized, but when the life of a valuable animal is at stake such possibilities are apt to be lost sight of.

One of the most interesting investigations made in the laboratory has been the study of some cases of this disease in man in which the infection was transmitted from a horse to the first case, a young man. During the course of his illness, which proved rapidly fatal, he was nursed by his brother, who contracted the disease in an acute form and died, whilst from material from a pustule on the face of the second case a third case was accidentally inoculated and assumed the chronic form. By means of a diphtheria outfit, pus from a cutaneous abscess on the face of the second case was collected after death and forwarded to the laboratory for examination and diagnosis, the nature of the disease being at that time unknown. The micro-organism was isolated from the pus and as it conformed, morphologically and biologically, in all media with glanders bacillus, it was inoculated (broth cultures) into the peritonea of male guinea pigs, in which it produced death in less than 24 hours, i. e., before sufficient time had elapsed to permit of the typical involvement of the testes. The bacilli were recovered in pure culture from the testicles and demonstrated in direct cover-slip preparations made from them.

The third case infected accidentally from this source developed a chronic form of the disease, characterized by the formation of abcesses in the muscles, which were treated surgically. From the pus and tissues obtained at operation the bacilli were recovered sparingly, but in pure culture. As evidenced by inoculation into the guinea pigs, the bacillus had become somewhat attenuated in the third case as compared with case No. 2, since it now produced the typical lesion of the testicle in the guinea pig and was not so rapidly fatal after intraperitoneal injection. Clinical and laboratory data has been most carefully collected and preserved and the investigation will be fully reported in the forthcoming biennial report of this board, which deals with human disease, and also in one of the medical journals in collaboration with the physicians and surgeons who were in charge of the cases.

It seemed worthy of mention in this report as showing very clearly the relation of this disease to both men and animals, since the channel of infection from the glandered horses to the young man in charge of them, from him to his brother and from him to the third case is so accurately demonstrated. The extreme virulence of the human form of the disease was shown in the first two cases by the character of the symptoms and acuteness of the illness as well as by the evidence furnished by guinea pig inoculations. The necessity for very careful supervision and control of this disease by boards of health is so apparent that comment is unnecessary.

HOG CHOLERA.

This disease is transmitted from animal to animal much as is typhoid fever transmitted from man to man. While the germs of this disease may to a limited extent be carried by dust, it cannot be classed as air borne in its character. The ordinary methods of transmission are by infected animals, healthy animals carrying the infection, and infected water. It may to a limited extent be borne also by birds flying from an infected pen or pasture. The number of diseased animals in Minnesota has been greatly reduced since 1897, when the work of inspection and quarantine was first vigorously begun by the Minnesota State Board of Health. One good citizen who wished to disparage the work of the board attributed the diminished amount of the disease to Providence rather than to sanitary methods, but careful observation would tend to show that Providence used sanitary methods as his agent of bringing about the change. In 1897, and two or three years following, the disease was very general throughout the southern part of the state, so much so that farmers were discouraged and were disposed to look upon sanitary methods as ineffective in the control of the disease. It was no uncommon thing to find nearly, if not all, the farms of the township infected with an extremely heavy mortality and great financial loss resulting. It was hard with such conditions prevailing to convince farmers that the disease was not air borne. After an issue of circulars setting forth the character of the disease, supplemented by a careful inspection of the first outbreaks in a township the general prevalence of the disease in a neighborhood disappeared and we have left rather its occasional appearance on, in many instances, a single farm in a neighborhood. It has been demonstrated time and time again that where the local officials have early recognized the disease or have called to their assistance the State Board of Health, the spread of the disease has been absolutely controlled. On the other hand it has been strongly demonstrated that the concealment of the disease by hog owners or neglect to quarantine on the part of local officials has been followed by general infection of many neighboring farms. The localization of the disease as shown by the following tables gives good evidence of what can be accomplished when it is placed under sanitary supervision.

Early in the work of the board in its attempt to regulate this disease many remedies consisting of practically inert drugs were in the market, lauded by certain individuals as cures for hog cholera. In spite of scientific demonstrations to the effect that there is no cure for this disease, except in its prevention, we still find a few men in the state who maintain that the disease is not infectious, and that it can be controlled simply by regulating the diet of the animals. Such false teaching is most unfortunate. True it is that improper feeding may place the alimentary canal of the hog in such a condition as to make the animal more susceptible to infection, but no amount of irregular or improper feeding can cause the specific disease hog cholera without the presence of the specific germ of the disease.

The work involved in the control of this disease has been largely in the hands of Dr. J. G. Annand, field veterinarian, whose report is as follows:

In looking over the field after the year's work, one of the notable features of the hog cholera outbreaks in the state in the year 1900 is that more than half in the southeastern corner of the state were in the following counties: Goodhue, Wabasha, Winona, Houston, Fillmore, Olmsted, Mower, Steele, Freeborn, Faribault. In Fillmore county we found that hog cholera came in from Iowa, and also that hog cholera had existed in Wisconsin prior to the outbreak in Winona county.

Another noticeable feature of the outbreaks is that the heaviest loss has been in counties bordering on other states.

In regard to Clay county, it should be stated that hog cholera had existed there for four years, the supervisors never having made any report. I found on visiting that locality that the disease had been present for some time in North Dakota, across the river. The outbreak in Minnesota this year was in the townships bordering on the Red River of the North. A great number of dead hogs were found in the river, and the health officers of the Minnesota side claim that the Dakota farmers threw hogs into the Red river; hence, the cause of the outbreak.

In Redwood county, in the town of Honner, according to the report of the chairman of the board of supervisors, hog cholera had existed in that town for four years, and that they had made no report, nor did they make any attempt to control the disease. This was the center of the outbreak for Redwood county.

In Lyon county the outbreak was a sequence of infection in '99 through the stock yards.

In regard to Stearns county, the origin of the outbreak was from hogs shipped in and fattened in stock yards, and the outbreak spread from this private stock yard. This was also the cause of outbreaks in Sherburne and Benton counties.

During the year 1901 the disease appeared in 21 counties, involving 37 townships, 1 vilage and 2 cities; and there were 92 outbreaks. Infection came by way of Mankato through hogs shipped from Missouri; hogs that developed the disease shortly after their arrival.

In the city of St. Paul the disease was found in slaughtered hogs.

In the village of Ellsworth, Nobles county, infected hogs were held in the stock yards.

Dr. Brimhall or myself visited all outbreaks with the exception of 17. Of these seventeen the disease appeared on one farm only in fourteen cases. In one township there were two outbreaks, in another township three outbreaks, and in another township five, which were not visited by a representative of the State Board of Health, as the health officers had the situation well in hand when it was reported to the board.

The outbreaks in Benton and Stearns counties appear to be carried over from 1900.

In Courtland and Traverse townships, Nicollet county, the outbreaks came from the hogs that were shipped into this district by way of Mankato from Missouri.

In Bloomfield township, Fillmore county, from which township it is claimed the disease spread in 1900, causing great loss, cholera again appeared in the private stock yards of Mr. Hughes. From information I obtained while in that vicinity it appears that he had cholera in his private stock yards three consecutive years.

In Wise Side and Lismore townships, Nobles county, hog cholera was allowed to spread before the supervisors took any active measures towards suppressing the disease. Diseased hogs were allowed to run at large, and dead hogs were not buried. We were about to prosecute a number of negligent farmers in these two townships, but decided not to, as their negligence was due largely to their misunderstanding of the law, rather than to indifference.

Compring the small loss in Minnesota from hog cholera in 1901 with the great loss sustained during previous years, the state is to be congratulated on the good work in dealing with this disease.

Had the neighboring states been as watchful the disease would have been even less. The fact that the spread of the disease can be prevented, if careful sanitary regulations are observed, has been fully demonstrated.

During 1902 the largest outbreak was in Hunter township, Jackson county, where eight farms were infected. In this township the chairman of supervisors paid no attention to the disease, allowed hogs to remain unburied, and did not report to the State Board of Health at the time of the outbreak. We were informed indirectly about four months after the outbreak first appeared.

In Freeborn township, Freeborn county, and Pleasant Prairie township, Martin county, there were seven farms infected with hog cholera during the summer season. The same conditions prevailed in these two townships as in Hunter township.

In Pleasant Prairie township the origin of the outbreak was on a farm whose owner allowed his hogs to run at large and go to different farms in the neighborhood, and the dead hogs were left unburied. On my visit there I found carcasses in different stages of decomposition, and also found that the dogs had been at the carcasses. This man was prosecuted. He admitted his guilt and paid his fine.

The one outbreak in La Crescent township, Houston county, was due to infection from Wisconsin.

In Rose township, Ramsey county, the infection was brought from the International Live Stock Exposition at Chicago.

In Burnsville township, Dakota county, and Carlson township, Freeborn county, the township supervisors were indifferent, and did not take any active steps to control the disease until after I made them a visit advising them as to their duties. They followed my advice, and there were no further outbreaks.

The outbreaks of hog cholera at Butternut Valley and Lincoln townships, Blue Earth county, were due to infection from Cherokee, Ia., brought in February.

With a few exceptions there was no spread of the disease in townships visited by Dr. Brimhall or myself.

There were only nine outbreaks reported to which either Dr. Brimhall or myself did not pay a visit. In eight of these only one farm was infected, and in the other case only two farms were infected, disease spreading no further.

It is encouraging to note that the township boards of health are becoming more prompt and energetic in their efforts to suppress the disease, and are beginning to realize that the spread of the disease can be prevented where infected hogs are properly quarantined and cared for and when the dogs are confined to their own premises.

Cholera appeared in 32 townships and two villages in 17 counties. In all there were 95 farms and one stockyard involved this year.

From Jan. 1, to April 23, 1903, there were 16 farms in 14 townships scattered through eleven counties affected with this disease of which I visited but two. One was at Alexandria, Douglas county. The outbreak appeared on one farm. The first hogs that showed the disease were taken from the railroad stockyards at Alexandria to this farm. As a result of this carelessness, the owner lost in the neighborhood of 70 hogs.

The other outbreak that I visited was in Eden Prairie township, Hennepin county. I could not learn how the disease originated on this place. They had lost some seven or eight hogs.

At Lake Park township, Becker county, and Eglon township, Clay county, quite a number of hogs died from cholera. These cases were under the care of Dr. Youngberg of Lake Park. The origin of this outbreak was from hogs that were exhibited at the World's Fair in Chicago and were apparently not looked after as they should have been at the time.

Outbreaks in Freeborn township, Freeborn county, Amherst township, Fillmore county, Hunter township, Jackson county, and Summit Lake and Lismore townships, Nobles county, were the continuation of outbreaks that had existed in these localities during 1902.

Mr. Pomplun visited the outbreak in Mounds View township, Ramsey county, where the disease was strictly quarantined and there was no further spread.

The following table gives the record of hog cholera for 1900, 1901, 1902 and 1903 to April 21:

HOG CHOLERA REPORT FOR 1900.

COUNTY.	Township.	Reported outbreaks in Twp.	Attitude of Local Health Officers.	Date of First Report.	Date of Last Report.	Date of Dr. Annand's Visit.	Outbreak quarantined.	Result.	Remarks.
Anoka	Centerville.....	5	Active................	Oct. 12	Oct. 17	Oct. 26............	Early.........	Effective.........	In that vicinity last year.
Benton......	Sauk Rapids...	2	Active................	Sept. 17	Sept. 22	Oct. 10............	Early.........	Effective.........	Infection from Stearns Co.
Benton......	Glendorado....	1	Active................	Nov. 10	Nov. 16	....	Early........	....	Owner moved from Sherburne Co.
Clay.........	Glyndon........	1	Active................	Oct. 24	Oct. 30	Oct. 24............	Early.........	Effective.........	
Clay.........	Kragnes........	1	Indifferent...........	Oct. 24	Oct. 24	Oct. 24............	No report	from C. B. S...	C. B. S. of Oakport twp. reports hog cholera present in Clay Co. for 4 years. This is the first report to State B. of H.
Clay........	Moland.........	2	Active................	Oct. 24	Oct. 24	Oct. 24............	No report	from C. B. S..	
Clay.........	Morken	2	Active................	Oct. 24	Nov. 5	Oct. 24............	Early.........	Effective.........	
Clay.........	Oakport........	5	Active................	Oct. 24	Oct. 31	Oct. 24............	Late	Effective.........	
Faribault ...	Brush Creek...	5	Active................	Aug. 15	Sept. 29	Aug. 15............	Early.........	Effective.........	Cholera present on two farms early in July, but not quarantined until July 25.
Faribault....	Blue Earth.....	3	Active after July 25	July 28	Oct. 18	July 25	Late	Effective.........	
Faribault....	Elmore	4	Active after July 25	July 28	Sept. 3	July 25	Late	Effective.........	
Faribault....	Seeley	6	Active................	Jan. 9	Dec. 18	Aug. 15............	Early.........	Effective.........	First outbreak Jan. 9, died out; second outbreak Aug. 6.
Faribault....	Winnebago	....	....	Nov. 2	....	....	....	....	
Fillmore	Amherst	1	Active.	Oct. 17	Oct. 29	....	Early.........	Effective.........	
Fillmore	Arendahl	2	Active................	Sept. 24	Oct. 15	....	Early.........	Effective.........	
Fillmore	Beaver	9	Active................	Sept. 25	Nov. 16	Sept. 25..........	Early.........	Disease spread...	Did not order dogs tied. Cholera in early spring, but not reported to C. B. S. until spread over eastern part of township.
Fillmore	Bloomfield	62	Active after Aug. 22	Aug. 18	Nov. 12	Aug. 22, Sept. 12	Late	Not effective.....	
Fillmore	Chatfield.......	2	Active................	Sept. 24	Dec. 10	....	Early.........	Effective.........	
Fillmore	Forestville.....	2	?	....	....	Aug. 22, Sept. 12	Early.........	Good—Sept. 12..	
Fillmore	Holt............	1	....	Nov. 1	Nov. 1	....	....	....	
Fillmore	Jordan	8	Active................	Aug. 31	Dec. 12	Sept. 22..........	Early...	Effective.........	F'll'w'd full instr'ct'ns of S.B.H.
Fillmore	Norway	8	Active................	Oct. 1	Oct. 22	....	Early.........	Effective.........	Cholera came from hogs taken from private stock yard in Rushford.
Fillmore	Pilot Mound ...	1	Active................	Oct. 19	Oct. 19	....	Early.........	Effective.........	
Fillmore	Preble..........	1	Active................	Oct. 31	Nov. 13	....	Early.........	....	
Fillmore	Rushford	7	Not very active......	Aug. 5	Sept. 26	Sept. 21..........	Late	?	
Fillmore	Spring Valley..	10	Indifferent...........	July 30	Sept. 26	Sept. 26..........	Early.........	Not satisfactory.	Did not follow S. B. H. instructions.
Fillmore	Sumner........	13	Active................	Aug. 16	....	Sept. 3 and 27....	Early.........	Effective.........	
Freeborn....	Alden	2	Active................	Sept. 25	Oct. 22	Oct. 30............	Early.........	Effective.........	
Freeborn....	Carlston........	5	Active................	Nov. 12	Nov. 12	Oct. 30............	Early.........	Effective.........	
Freeborn....	Emmons (Vil.)	3	Active................	Nov. 2	Nov. 8	Nov. 12............	Early.........	Effective.........	
Freeborn...	Freeman.......	3	Active................	Feb. 21	Nov. 1	Nov. 1.............	Early.........	Effective.........	

HOG CHOLERA REPORT FOR 1900—Continued.

County.	Township.	Reported outbreaks in Twp.	Attitude of Local Health Officers.	Date of First Report.	Date of Last Report.	Date of Dr. Annand's Visit.	Outbreak Quarantined	Result.	Remarks.
Freeborn	Mansfield	2	Indifferent	Nov. 1	Nov. 14	Nov. 1	Late	....	
Freeborn	Nunda	6	Active	Nov. 1	Nov. 13	Nov. 1	Early	Fairly good	
Freeborn	Pickerel Lake	7	Active	Nov. 1	Nov. 21	Nov. 1	?	Effective	Board doing nothing and nearly all these infected at time of Dr. Annand's visit.
Goodhue	Belvidere	27	Indifferent	Oct. 16	Oct. 26	Oct. 16	Late	Not effective	
Goodhue	Goodhue	8	Indiff. until Oct. 16	Oct. 16	Dec. 19	Oct. 16	Late	Effective	
Goodhue	Hay Creek	24	Indiff. until Oct. 16.	Oct. 16	Dec. 4	Oct. 16	Late	Effective	
Goodhue	Wacouta	....	....	Sept. 15	....	....	....	....	
Grant	Lien	7	Active	Nov. 16	Nov. 16	Nov. 15	Late	....	
Hennepin	Brooklyn	3	Active	Jan. 16	Feb. 28	....	Early	Effective	
Houston	Caledonia	4	Active	Dec. 5	Dec. 19	Dec. 19	....	....	
Houston	Houston	1	Active	Sept. 13	Sept. 13	....	Early	Effective	
Houston	Money Creek	9	Active	Sept. 10	Nov. 24	Sept. 22	Early	Somewhat ef'tive	
Houston	Mound Prairie	2	Active	Nov. 9	Nov. 14	....	Early	?	
Houston	Yucatan	2	Active	Oct. 22	Nov. 22	....	Early	?	
LeSueur	Sharon	5	Indifferent	Nov. 9	Nov. 21	Nov. 9	Late	?	
Lyon	Eidsvold	2	....	....	Dec. 18	....	No action	Died out Dec. 19	
Lyon	Fairview	3	Indifferent	Oct. 5	Oct. 5	Oct. 5	Late	Died out	Quarantined a few cases, then stopped. After Dr. Annand's visit, quarantined again.
Lyon	Lucas	18	Active	Sept. 11	Oct. 13	Oct. 5	Late	Effective	
Mower	Racine	?	Indifferent	Sept. 10	Sept. 10	....	?	?	
Mower	Windom	7	Active	Sept. 25	Nov. 27	....	Late	?	
Nicollet	Belgrade	3	Indifferent	Nov. 8	Nov. 17	Nov. 8	Not q'r'tined	Died out	
Olmsted	Dover	2	Active	Sept. 19	Sept. 20	Sept. 18	Early	Effective	
Olmsted	High Forest	1	?	Sept. 10	Sept. 10	....	Early	?	
Olmsted	Orion	?	?	Oct. 11	Oct. 11	....	?	?	
Olmsted	Quincy	20	Active	Aug. 18	Oct. 10	Aug. 30, Sept. 19	Late	Not effective	Did not follow instructions regarding dogs and doves.
Olmsted	Salem	1	Active	Jan. 4	Jan. 4	....	Early	Effective	
Olmsted	Viola	2	Active	Aug. 30	Sept. 29	Aug. 30	Early	Effective	
Ottertail	Pelican Rapids	....	Indifferent	Dec. 3	Dec. 14	....	....	....	
Ramsey	Rose	1	Active	Oct. 12	Oct. 12	....	Early	Effective	
Redwood	Delhi	8	Indifferent	Oct. 20	Nov. 1	Oct. 19	Late	?	
Redwood	Granite Lake	1	Active	Apr. 23	Apr. 23	Oct. 19	Early	Effective	
Redwood	Honner	5	Indifferent	Oct. 19	Nov. 2	Oct. 19	Late	....	All sick hogs died before quarantined.
Redwood	Johnsonville	10	Active	Jan. 8	May 31	June 25	Early	Effective	Cholera appeared at two different periods between dates given. All dead June 25.
Redwood	Underwood	?	Indifferent	Oct. 4	Nov. 13	Oct. 4	No quar'tine.	....	
Redwood	Swedes Forest	2	Active	Nov. 26	Dec. 22	....	....	....	
Redwood	Kintire	2	Active	Nov. 13	Dec. 18	....	Early	?	
Redwood	Vesta	6	Active	Oct. 3	Nov. 5	Oct. 3	Late	?	

Renville	Beaver Falls	5	Indifferent	Oct. 18	Oct. 18	Oct. 18	No quar'tine.		
Renville	Florita	2	Indifferent	Oct. 6	Oct. 17	Oct. 6	Late	?	
Renville	Henryville	5	Active	Oct. 6	Oct. 18	Oct. 6	Early	Effective	
Scott	Louisville	10							
Scott	Jackson	16							
Sherburne	Clear Lake	1	Active	Nov.	Nov. 2	Oct. 10	Early	Effective	
Sherburne	Haven	11	Active	Sept. 10	Nov. 5	Sept. 10, Oct. 10	Late	Not effective	Did not enforce their own regulations.
Stearns	Le Sauk	8	Indifferent	Sept. 11	Oct. 11	Sept. 11, Oct. 11	No quar'tine.		Dogs ordered tied up. Instructed Dr. Ward to send for file, but he neglected it. Even after Dr. Annand's 2nd visit report.
Stearns	St. Augusta	42	Indifferent	Sept. 10	Dec. 1	Sept. 10, Oct. 10	Late	Not effective	
Stearns	St. Cloud	20	Indifferent	July 17	Oct. 10	Sept. 10, Oct. 10	Late	Not effective	
Stearns	St. Joseph	1	Active	Oct. 16	Oct. 16		Early	?	
Steele	Bl'ming Prairie	1	Active	Aug. 3	Aug. 3		Early	Effective	
Steele	Clinton Falls	3	Indifferent	Sept. 19	Sept. 19		?	?	
Steele	Medford	2	Active	Sept. 24	Sept. 27		Early	?	
Steele	Merton	6	Active	Aug. 21	Sept. 6	Aug. 21	Late	Effective	
Wabasha	Chester	8	Indifferent	Oct. 11	Oct. 16	Oct. 16	Late	?	
Wabasha	Elgin	15	Indifferent	July 15	Sept. 15	July 15, Aug. 30	Late	Not effective	
Wabasha	Kellogg (Vil.)	1	Active	Sept. 29	Sept. 29		Early	Effective	
Wabasha	Mt. Pleasant	3							
Wabasha	Plainview	17	Indifferent	Aug. 11	Oct. 20	July 15, Aug. 30	Early	Not effective	Did not order dogs tied, nor doves shot.
Wabasha	Zumbro Falls	1							Cholera appeared at two different periods. Did not follow instructions.
Wabasha	Watopa	11	Indifferent	Apr. 20	Dec. 26	July 13			
Wabasha							Late	?	
Waseca	Iosco	3	Indifferent	Oct. 25	Oct. 25				
Watonwan	Riverdale	1	Active	Sept. 3	Sept. 24	Sept. 15	Early	Effective	
Watonwan	Rosendale	2	Active	Nov. 13	Nov. 22		?	?	
Winona	Elba	1	Active	Jan. 5	Jan. 5	June 15	Early	Effective	Cholera appeared at two different periods. Quarantined first and checked spread. Did not quarantine second time and disease spread.
Winona	Fremont	20	Active	Aug. 27	Oct. 8	Sept. 20	Early	Not effective	
Winona	Hart	25	Indifferent	May 23	Oct. 3	Aug. 24, Sept. 21			
Winona	Pleasant Hill	12	Active	Sept. 8	Dec. 4		Early	?	
Winona	Saratoga	1	Active	Sept. 28	Sept. 28		Early	?	
Winona	St. Charles	13	Active	Oct. 10	Dec. 17		Early	?	
Winona	Utica	12	Active	Oct. 13	Dec. 12		Early	?	
Winona	Warren	1	Active	Nov. 6	Nov. 6		Early		
Winona	Whitewater	3	Active	Oct. 1	Nov. 15		Early	Effective	
Winona	Wiscoy	2	Active	Oct. 12	Oct. 15		Early	Effective	
Wright	Clear Water	4	Active	Nov. 3	Nov. 21		Early	?	Disease here in August. Did nothing until Dr. Annand's visit.
Yellow Med.	Echo	16	Indifferent	Sept. 24	Oct. 9	Oct. 2	Late	?	
Yellow Med.	Posen	2	Active	Oct. 3	Oct. 4	Oct. 4	Early	Effective	

HOG CHOLERA REPORT FOR 1901.

COUNTY.	Township.	Reported Outbreaks.	Attitude of Local Health Officer.	Date of First Report.	Date of Last Report.	Date of Dr. Annard's Visit.	Outbreak Quarantined	Result.	Remarks.
Blue Earth	City of Mankato	1	Active	Nov. 6	Dec. 5	Dec. 5			Hogs were shipped in from Missouri and shipped again to market. Reported by Federal Inspector.
Benton	Langola	1	Active	May 2	June 6		June 6	Effective	Owner thinks hogs were infected from corn shipped from Iowa.
Clay	Morken	1	Active	Jan. 14	Jan. 14		Jan. 14	Effective	
Dodge	Concord	1	Active	Dec. 23	Dec. 23		Dec. 23	Effective	
Fillmore	Jordon	1	Active	Feb. 23	Mar. 15	Nov., 1900	Feb. 23	Effective	This outbreak appeared to be a continuation from 1900.
Fillmore	Harmony	1	?	Jan. 9	Jan. 9				Dr. Brimhall instructed board thro' the mail. Nothing more was heard from them.
Fillmore	Bloomfield	1	Active	Nov. 7	Nov. 7	Nov. 7	Nov. 8	Effective	Outbreak in private stocky'ds of Mr. Hughes. Cholera been there three consecutive years.
Freeborn	Albert Lea	1	Not informed	Nov. 1	Nov. 5	Nov. 5			Ran on to it by chance while inspecting his neighbors herd.
Freeborn	Freeman	1	Active	Jan. 9	Jan. 9		Jan. 9	Effective	
Freeborn	Nunda	1	Active	Apr. 3	Apr. 3		Apr. 3	Effective	
Hennepin	Richfield	1	Active	Feb. 19	Mar. 4		Mar. 4	Effective	
Lyon	Grand View	1	Indifferent	Oct. 19	Oct. 27	Oct. 27, Dr. Brimhall	Oct. 27	Effective	
Lyon	Monroe	1	Not informed	Dec. 31	Jan. 3	Jan. 3	Jan. 3	Effective	Hogs were shipped and sold for slaughter. Reported by Federal Inspector.
Martin	Manyaska	2	Indifferent	Oct. 29	Nov. 4	Oct. 29	Nov. 1	Effective	
Martin	Elmcreek	1	Active	Oct. 29	Oct. 29	Oct. 29	Nov. 2	Effective	
Martin	Jay	4	Active	Oct. 29	Dec. 10	Oct. 29	Nov. 2	Effective	
Martin	Fox Lake	2	Active	Oct. 26	Dec. 6	Oct. 29	Oct. 26	Effective	
Mower	Lansing	2	Indifferent	Sept. 30	Oct. 8	Oct. 8	Oct. 8	Effective	
Mower	Udolpho	1	Active	Nov. 23	Nov. 23		Nov. 23	Effective	
Nicollet	Courtland	1	Indifferent	Nov. 22	Nov. 22	Nov. 22	Nov. 22	Effective	
Nicollet	Traverse	1	Indifferent	Nov. 16	Mar.'02	Nov. 22	Nov. 22	Effective	
Nobles	West Side	12	Indifferent at first	Oct. 1	Nov. 23	Oct. 15	Oct. 16	Effective	This outbreak was allowed to spread before the supervisors took action.
Nobles	Lismore	14	Active	Oct. 1	Dec. 2	Oct. 15	Oct. 12	Effective	This outbreak was allowed to spread before the supervisors took action.

Nobles	Leota	4	Indifferent	Oct. 15	Oct. 30	Oct. 15	Oct. 16	Effective	Fortunately this outbreak did not spread.
Nobles	Ellsworth (Vill.)	1	Indifferent	Sept. 24	Oct. 1	Oct. 1, Dr. Brimhall			
Olmstead	Pleasant Grove.	1	Active	Sept. 10	Sept. 16		Sept. 14	Effective	
Ramsey	City of St. Paul.	1	Active	Dec. 7	Dec. 7			Effective	Hogs were slaughtered.
Ramsey	Rose	1	Active						At Experiment Station.
Renville	Troy	1	Active	Aug. 24	Aug. 29	Aug. 27	Aug. 29	Effective	
Renville	Beaver Falls	2	Active	Nov. 5	Nov. 24	Nov. 11	Nov. 11	Effective	
Renville	Bird Island	1	Not informed	April	Aug. 27	Apr. 12, Dr. Brimhall			Reported by Dr. Ketchum, Federal Inspector So.St.Paul.
Renville	Winfield	1	Active	Sept. 4	Sept. 4		Sept. 4	Effective	
Scott	Sandcreek	3	Active	May 5	Nov. 30		May 22	Effective	
Scott	Helena	1	Active	Dec. 3	Dec. 3		Dec. 3	Effective	
Stearns	Le Sauk	1	Active	July 20	July 20	July 20, Dr. Ward	July 20	Effective	
Wabasha	Glasgow	2	Active	Oct. 10	Oct. 10		Oct. 10	Effective	
Wabasha	Greenfield	1	Not informed	Dec. 26	Jan. 2	Jan. 2 '02 Dr. Brimhall	Jan. 2, 1902	Effective	Reported by owner.
Waseca	Iosco	5	Active	Nov. 10	Nov. 10		Nov. 10	Effective	
Winona	Warren	1	Active	June 6	June 6		Nov. 6	Effective	
Yellow Med.	Sioux Agency	2	Active	June 18	June 29	July 12	June 29	Effective	

HOG CHOLERA REPORT, 1902.

COUNTY.	TOWNSHIP.	Reported Outbreaks.	Attitude of Local Health Officer.	Date of First Report.	Date of Last Report.	Date of Dr. Annand's Visit.	Outbreak Quarantined.	Result.	Remarks.
Blue Earth..	South Bend....	1	Active	May 6	May 14	May 14..........	May 14......	Effective.........	
Blue Earth..	Butternut Val.	3	Not active...........	Nov. 12	Nov. 12	Nov. 12..........	No............	Died out.........	Disease spread from Lincoln Tp.
Blue Earth..	Lincoln	4	Not active	Nov. 12	Nov. 12	Nov. 12..........	No............	Died out.........	Disease died out after a great many farmers lost most of their hogs.
Big Stone...	Big Stone......	1	Active	Dec.29,'01	Jan. 8	Jan. 8, Dr. Brimhall	No............	Died out.........	Swine plague. Health officers had charge of outbreak.
Chisago	Chisago	1	Not notified..........	Sept. 20	Sept. 27	Sept. 23..........	Sept. 23......	Effective.........	Evidently got infection at S. fair.
Chippewa...	Sparta	3	Indifferent	Sept. 18	Oct. 2	Oct. 2..........	No............	Died out.........	Two farms had disease early in year and died out; only one farm infected Oct. 2.
Dakota......	Burnsville	5	Indifferent	Nov. 4	Nov. 8	Nov. 7..........	No............	Died out from Isolation	Disease appeared in township in July.
Fillmore	Preston	4	Active............ ..	Oct. 7	Nov. 12	Oct. 14 and 28....	Oct. 28......	Effective.........	
Fillmore	Carrollton	4	Indifferent	Oct. 14	Nov. 5	Oct. 14 and 28....	Nov. 28......	Died out.........	
Freeborn....	Carlston	5	Indifferent at first..	Oct. 15	Nov. 20	Oct. 16 and 30....	Oct. 17......	Died out.........	
Freeborn....	Freeborn.......	7	Indifferent at first..	Oct. 16	Oct. 28	Oct. 16 and 30....	Oct. 17......	Died out.........	
Freeborn....	Albert Lea	4	Indifferent	Oct. 30	Oct. 30	Oct. 30..........	No............	Died out.........	
Freeborn....	Bancroft.......	3	Active	Nov. 6	Nov. 12	Oct. 30..........	Nov. 11	Effective.........	
Freeborn....	Hayward	1	Active................	Dec. 16	Dec. 16	....	?	Effective.........	
Freeborn....	Alden	1	Active................	Oct. 16	Oct. 16	Oct. 16..........	Oct. 16......	Effective.........	
Houston	La Crescent ...	5	Active................	Apr. 17	May 15	Apr. 8, Dr. Brimhall	Apr. 17......	Effective.........	This outbreak came from Wis.
Jackson	Evington	6	Active................	Oct. 13	Nov. 28	....	Oct. 13......	Effective.........	
Jackson	Hunter	8	Indifferent	Dec. 3	Dec. 10	Dec. 3..........	Dec. 8......	Effective.........	
Jackson	Jackson City...	1	....	Jan. 6	Feb. 3	....	....	Effective.........	Stock yards.
Lyon	Monroe	1	Not notified.........	Jan. 3	Jan. 3	Jan. 3..........	Jan. 3......	Effective.........	
Martin	Manyaska	1	Active................	Feb. 21	Feb. 21	....	Feb. 21......	Effective.........	These outbreaks originated on the farm of Daniel Page, who allowed his hogs to run all over the neighborhood; also left his dead hogs unburied. He was prosecuted Nov. 29, '02.
Martin	Pleasant Prai'e	7	Indifferent	Oct. 15	Oct. 30	Oct. 15 and 29....	Oct. 30......	Effective.........	
Mower	Frankford	1	Active.,..............	May 23	May 23	....	May 23......	Effective.........	
Nobles	Hersey	3	Active................	Sept. 20	Oct. 27	Oct. 8-9, Dr. Brimhall	Oct. 13......	Effective.........	
Nobles	Lismore	2	Active................	Nov. 15	Dec. 4	Dec. 4..........	Nov. 15......	Effective.........	
Nobles	Loraine	1	Active................	Sept. 27	Sept. 29	Oct. 8-9, Dr. Brimhall	Sept. 27......	Effective.........	
Pipestone ...	Pipestone	1	Indifferent	Dec. 3	Dec. 3	....	?	?	This outbreak was at the state farm. Infected while at Chicago stock show.
Ramsey	Rose............	1	Not notified.........	Dec. 29	Dec. 29	....	....	....	
Ramsey	Mounds View..	1	Active................	Apr. 1	Apr. 2	....	Apr. 2......	Effective.........	
Ramsey	New Brighton Vil..	1	Active................	Jan. 8	Jan. 8	Jan.	Jan. 8......	Effective.........	
Rock	Battle Plaine..	2	Active................	Dec. 4	Dec. 6	Dec. 4..........	Dec. 5......	Effective.........	
Rock	Vienna	4	Indifferent	Dec. 1	Dec. 4	Dec. 4..........	Dec. 1......	Died out.........	
Wabasha	Highland	1	Indifferent	May 26	May 26	....	?	Died out.........	
Wabasha	Glasgow........	2	Indifferent	May 26	May 26	....	?	Died out.........	

HOG CHOLERA REPORT, 1903, TO APRIL 21st.

COUNTY.	TOWNSHIP.	Reported Outbreaks.	Attitude of Local Health Officer.	Date of First Report.	Date of Last Report.	Date of Dr. Annand's Visit.	Outbreak Quarantined.	Result.	Remarks.
Becker	Lake Park	1		Jan 15					Outbreak originated from hogs that were exhibited at Chicago stock show.
Chippewa	Havelock	1	Active	Apr. 7	Apr. 13		Apr. 13	Effective	
Douglas	Alexandria	1		Jan. 30	Feb. 9	Feb. 3			From hogs that were taken from R. R. stockyards.
Dakota	Burnsville	2	Active	Jan. 9	Jan. 9		Jan. 9		From 1902 outbreak.
Freeborn	Freeborn	1	Active	Feb. 2	Feb. 2		Feb. 2		From 1902 outbreak.
Fillmore	Amherst	1	Active	Jan. 7	Jan. 7		Jan. 7		From 1902 outbreak.
Jackson	Hunter	1	Active	Feb. 9	Feb. 9		Feb. 9		
Hennepin	Eden Prairie	1	Active	Jan. 23	Feb. 6	Feb. 6	Feb. 1		
Hennepin	St. Anthony	1	Inactive						
Hennepin	Richfield	1	Active	Jan. 17	Mar. 4		Jan. 17		From 1902 outbreak.
Nobles	Summit Lake	1	Active	Feb. 26	Mar. 26		Mar. 26		From 1902 outbreak.
Nobles	Lismore	2	Active	Feb. 2	Feb. 2		Feb. 2		
Ramsey	Mounds View	1	Active	Feb. 13	Feb. 16		Feb. 16		
Clay	Eglon	1							Outbreak originated from hogs that were exhibited at Chicago stock show.

Laboratory Investigations. Besides the work of the board above reported in the diagnosis and quarantine of hog cholera and swine plague, the following special investigations have been made by the Veterinary Department and the Laboratory:

State Experiment Station.—On Jan. 15, 1901, there was received in the laboratory from Dr. M. H. Reynolds, of the State Experiment Station, the liver, lung, heart, spleen, kidney and several feet of small intestines of a pig, which had died the morning of January 14th and had been examined post-mortem by Dr. Reynolds on the evening of the 14th. Accompanying the specimen was the following note from Dr. Reynolds:

Jan. 14, 1901.

Dr. F. F. Wesbrook, University,

Dear Doctor: These specimens came from a mature hog, which died this forenoon, after several days of apparently slight indisposition. The death was rather sudden and unexpected. Examination post mortem revealed mainly a general and most intense enteritis. The intestines contained a considerable quantity of what appeared to be mainly blood. A very extensive effusion of peculiar inky red serum in both cavities, but pleuritis and peritonitis not especially marked in abdomen and thoracic walls. Liver soft, friable, wet, its anterior surface covered by small, grayish patches of recent exudate. Kidneys apparently normal. Spleen, normal size, soft. Lungs show a general broncho-pneumonia with pleuritic exudate on surface. Examination of superficial subcutaneous tissues showed two areas (one in each groin) resembling those found in hemorrhagic septicaemia.

Another subject examined post-mortem today—dead about 36 hours—showed one lung with a small, clearly-defined area which looked very much like areas seen in lungs of swine plague subjects; but the other lung showed a general broncho-pneumonia. Cæcum near valve showed pits which might have been those of hog cholera ulcers, but the intestine was in poor condition for examination and I could not be certain.

M. H. REYNOLDS.

When received in the laboartory all the specimens were filled with gas bubbles and gave off a marked odor of decomposition. Direct coverslip preparations from all the organs, except the intestines, showed large numbers of short, thick, spore-bearing bacilli, apparently unmixed with other bacteria. Cultures were made in duplicate in broth, on serum, plain agar, litmus lactose agar and litmus glucose agar from the spleen, liver and lung. These were grown at room and incubator temperature, ærobically, but no growth developed on any of the cultures at any time. Cultures were made in glucose glycerine broth and in glucose agar, which were grown anærobically, at incubator temperature, and others in glycerine glucose broth, which were grown anærobically, at room temperature. All these developed pure cultures of the large spore-bearing bacillus, apparently the same as that observed in direct coverslip preparations. The organism grew well at both room and incubator temperature, developed abundant gas, was non-motile and apparently strictly anærobic. What was its relation to the disease process in the animal from whose organ it was taken is doubtful. Swine plague or hog cholera bacilli, if originally present, must have been destroyed either by the growth of this organism of some other agency.

State Experiment Station.—Jan. 19, 1901, Dr. Wilson collected direct coverslip preparations and cultures from the tissues and organs of the second pig dead of supposed hog cholera at the State Experiment Station. Dr. M. H. Reynolds conducted the autopsy. Direct coverslip preparations, stained with eosin and methylene blue, showed from the—

(a) Lung, no bacteria.
(b) Heart's blood, (1) bacteria resembling swine plague, that is, with polar granules; (2) bacteria resembling hog cholera bacilli.
(c) Liver, (1) bacteria resembling capsulated diplobacilli, or diplococci (more like cocci); (2) bacilli resembling swine plague bacilli; (3) large growth of cocci (capsulated).
(d) The spleen, (1) bacilli resembling swine plague bacilli, or small diplococci; (2) thick capsulated bacilli.
(e) The kidney, many red blood cells, a few coarsely granular or hyaline cells, many epithelial cells and phagocytes filled with bacilli like swine plague bacilli or diplococci.

Aerobic cultures from lung: Hanging drop broth showed many small, short, non-motile bacilli, some in chains or two or three pairs (swine plague?); also a few larger bacilli about the size of colon bacilli, actively motile.

Stained preparations from agar showed apparently pure cultures of swine plague (?) bacilli. Heart's blood, hanging drop from broth, no growth; stained preparations from serum and broth, no growth; liver, no growth in broth cultures; on serum, large square-ended bacilli, probably *B. subtilis*; spleen, hanging drop broth, all bacilli seemed to be motile, apparently the large and small varieties of diplo-bacilli. Preparations from agar from the small colony showed bacilli somewhat like swine plague. From the large colony small, colon-like bacilli; kidney, hanging drop broth, motile, slender bacilli, somewhat like colon or a trifle larger (hog cholera?). Preparations from broth, slender, rather long bacilli, somewhat colon-like.

Incubated, anærobic cultures from lung, liver, heart's blood, spleen and kidneys showed growth only from lung and spleen. Cultures from these organs were apparently pure, of small diplococcoid bacilli (swine plague). Cultures from single colonies were streaked out in litmus lactose agar, after 24 hours' growth. Seven of those resembling, morphologically, swine plague or hog cholera bacilli, sown on the various media on which they were all easily identified, as follows: From the lung and spleen, *B. suisepticus*; the spleen, *B. choleræ suis* and *B. coli communis*; from the kidney, *B. coli communis* only.

State Experiment Station.—Monday, Jan. 28, 1901, specimens were collected by Dr. Wilson from a pig dead eight hours before, after a short illness, at the State Experiment Station. The animal was a three-months-old Tamworth, weight 50 to 70 pounds. Externally the skin of abdomen showed numerous minute, purplish points. In removing the skin from the animal very many pin-point ecchymotic areas were found scattered throughout the subcutaneous and superficial muscles over the entire body. In addition to this, on the extremities, in the groins and along the back were large hemorrhagic areas. One on the left groin was an area 15 c. m. in diameter, consisting of numerous hemorrhages which had coalesced. The subcutaneous tissue was infiltrated with yellow serum. The inguinal and cervical glands were all enlarged to several times their normal size in diameter throughout. A similar condition of the glands in the internal regions of the body was also present. The pericardium contained small hemorrhagic areas; also the wall of the heart had numerous hemorrhages. The lungs were typical "swine-plague" lungs, i. e., contained large collapsed areas of a dark red color. The stomach and intestinal walls contained numerous small, thickly set ecchymoses. Liver was normal; the spleen was swollen, dark and soft. The cortex of the kidneys was specked with minute ecchymoses; the bladder wall was swollen and black, with hemorrhages throughout its entire extent; the urine was dark red.

Coverslip preparations from the inguinal glands, heart's blood, lung, spleen and liver all showed numerous swine plague (?) bacilli.

Cultures in broth on serum and plain agar gave abundant growth of swine plague bacilli from the inguinal gland, lung, heart's blood, spleen, liver and urine.

State Experiment Station.—Jan. 31, 1901, Dr. Wilson collected specimens from two pigs on which autopsies were performed by Drs. Reynolds and Brimhall, at the State Experiment Station. Pig No. 1, a female Tamworth, weighing about 60 pounds, had been ailing for some time, but died suddenly on the morning of January 31st. Numerous small purplish spots were present over the skin of abdomen. Scattered over the subcutaneous tissues, over the entire body and throughout all of the internal organs were numerous small ecchymoses. No large hemorrhagic areas were present, except some from one-half to one inch in diameter about the digits and the posterior extremities. Several ulcers about one c. m. in diameter were present in the sacrum.

Direct coverslip preparations from lungs, heart's blood, spleen and liver showed a few small diplococcoid bacilli. Cultures in broth, on serum and on agar, showed from the lungs swine plague bacilli unmixed with other organisms. From the spleen and liver, swine plague bacilli associated with hog cholera bacilli.

A second pig, which was examined on the same day, was a male Tamworth, weight 150 pounds. Animal had been sick several days and had died but a few hours before the autopsy. The anatomical lesions were parallel with those noted in the first pig. Direct coverslip preparations and cultures gave parallel results, i. e., swine plague bacilli from the lung and swine plague and hog cholera bacilli from spleen and liver.

State Experiment Station.—Feb. 11, 1901, at 2 p. m., Drs. Wesbrook and White collected specimens from the various organs and tissues of a Yorkshire sow, No. 250, which had died late at night February 9th, and concerning which they made the following autopsy notes: Pleural cavities contained some fibrinous exudate; pericardial cavity, slight fibrinous exudate; considerable fluid; the pericardium showed a few small petechiæ; left lung at the anterior end showed a large area of hemorrhage with whitish areas (abcesses); few small pin-head sized white raised spots with a hemorrhagic ring about them. Similar but smaller areas on the anterior end of the right kidney; numerous pin-point white areas beneath the capsule; skin lesions were petechial hemorrhages especially well marked about the buttocks.

Direct coverslip preparations stained with eosin and methylene blue from the lung showed diplococci, small, belted, ovoid bacilli and large putrefactive organisms; from the heart's blood, nothing; from the spleen, same as the lung, except no diplococci; from the liver, same as spleen.

Broth and serum cultures from all the organs developed swine plague bacilli, and from the spleen and liver, hog cholera bacilli. These were mixed with staphylococci, *B. coli communis* and a large liquefying bacillus, probably contaminations.

State Experiment Station.—Feb. 11, 1901, at 2 p. m., Drs. Wesbrook and White collected specimens from the body of a Yorkshire sow, No. 775, which had died February 9th, late at night, and concerning which the following autopsy notes were made at the time:

Skin generally filled with small petechiæ. Large patches with hard, dried skin (necrosis) over each quarter and on back of neck. Extensive small hemorrhages into subcutaneous fat of ventril midline. Large patches seen externally correspond to extensive hemorrhagic and necrotic areas in subcutaneous tissues. One area of necrosis on side does not show externally. Hemorrhages well shown over both hocks. Lungs showed many areas solid and grayish, raised. Some larger areas, solid, dark and depressed. Pericardium contained a few petechiæ. Large intestines showed minute ulcers in cæcum near valve.

Direct coverslip preparations, stained with eosin and methylene blue, from the spleen and liver, lung and heart's blood, all showed large, putrefactive bacilli and a few showed cocci.

Cultures in broth and on serum from the various organs noted above developed staphylococci, *B. coli communis* and one liquefying organism. *B. suisepticus* was present in the heart's blood and lung; *B. choleræ suis* was found in the spleen.

State Experiment Station.—July 9, 1901, there was received in the laboratory from the State Experiment Station a pig killed one hour before, when almost dead, and the heart and lungs of a second pig dead about three hours before. Animals were about four or five weeks old and had been sick but a very short time. The one brought to the laboratory was in excellent condition. The lungs, which had already been removed from the body of pig No. 1, showed typical alternating red and gray spotted "lung of swine plague." The heart wall and pericardium showed no lesions. Complete autopsy on the body of pig No. 2 showed the same appearance of the lung as that noted in pig No. 1. In addition there was considerable effusion of straw-colored serum into the pericardium and a few minute ecchymoses of the heart wall. No other gross lesions were discovered in any portion of the body.

Direct coverslip preparations and cultures in broth and on serum were made from the lung, pericardial fluid and heart's blood.

Direct coverslip preparations (stained with eosin and methylene blue) showed from the lung a few small diplococcoid bacilli; those from the pericardial fluid and heart's blood showed no bacteria.

Cultures on serum and in broth from the lung gave a fair growth of a small diplococcoid bacillus apparently unmixed with other organisms. This organism, when grown on the various media, proved to be *B. suisecpticus.* No bacteria grew in any of the cultures from the pericardial fluid or heart's blood.

Ghent, Minn.—Oct. 29, 1901, Drs. Brimhall and Wilson visited the farm of Mr. J. P. Smiley, three miles south of Ghent, Minn., and made autopsies on the bodies of two shoats, one dead about an hour and the other killed for purposes of autopsy. These animals were the first noticed by the owner to be affected with hog cholera. His neighbor had recently lost 70 hogs with the disease, which was, presumably, communicated to Mr. Smiley's herd through carelessness on the part of the neighbor in permitting his animals to range along a creek which flowed thence through Mr. Smiley's farm. At autopsy of the two animals, small ecchymotic areas were found subcutaneously and a very few in some of the internal organs. The chief lesions, however, were those of the lungs, which presented large, "collapsed," purplish red areas in marked contrast with the white, normal lung, the typical "swine plague" lung. The spleen of pig No. 2, the one killed for autopsy, was enormously enlarged. Direct coverslip preparations, broth and serum cultures, were made from the lung, pericardial fluid, heart's blood and spleen of each of these animals.

The direct coverslip preparations from the lung showed a very few diplococcoid bacilli. Those from the other organs and tissues showed no bacteria. Cultures from pig No. 1, which had been dead an hour before the autopsy was performed, showed small diplococcoid bacilli—*B. suisepticus*—from the lung and spleen. In addition in the spleen were found larger, colon-like bacilli, proven later to be *B. choleræ suis.* These were also present in cultures from the pericardial fluid and heart's blood. Of pig No. 2 the cultures from the pericardial fluid, heart's blood and spleen remained sterile. Those from the lungs showed small diplococcoid bacilli only—*B. suisepticus.*

Detroit, Minn.—Jan. 1, 1903, there was received in the laboratory two quart Mason's jars containing pieces of tissue. These specimens were accompanied by absolutely no data. Consequently one week elapsed before it was possible to get sufficient data to determine that they came from Dr. A. Youngberg, Detroit, Minn., who had removed the specimens from a pig dead of supposed swine plague or hog cholera.

The data supplied by Mr. Youngberg is as follows:

"Hogs presented the following symptoms before death: Two weeks before death they began to cough and lose their appetite and have a slight attack of diarrhoea. The faeces were of a clay color. These symptoms increased in severity until about 24 hours before death, when they commenced to breath very rapidly, the respirations being about 28 per minute and very laborious. Two or three hours before death there was hemorrhage from both nostrils.

"At autopsy the lungs were found more or less hepatized; mediastinal pleura was of a mahogany color; the liver and kidneys seemed all right. This is, properly speaking, an infectious lung disease, but it did not act exactly like swine plague. I rinsed the jars in boiling water and as I opened the thoracic cavity I cut off a few pieces and put them in."

The specimens had been kept constantly frozen and on January 7th the jars were removed from them and the specimens examined. Direct coverslip preparations and cultures were made and examined. The specimens consisted of a portion of heart, lung, spleen and liver. The results of the bacteriological examinations, after numerous cultures and sub-cultures, were as follows:

(a) *Lung.*—From the lung were isolated—
    1. *B. suiscepticus* (swine plague bacillus).
    2. A. gram-staining diplococcus (probably diplococcus pneumoniæ).
    3. *B. coli communis.*
(b) *Heart.*—From the heart was isolated—
    1. *B. pyocyaneus.*
(c) *Spleen.*—From the spleen were isolated—
    1. *B. suisepticus* (swine plague baccillus).
    2. *B. coli communis.*
(d) *Liver.*—From the liver was isolated—
    1. *B. coli communis.*

Fifty-four individual colonies from the lung and spleen were studied to determine if perchance any of them were *B. choleræ suis.* All turned out to be typical *B. coli.* Thus while *B. choleræ suis* was not absolutely excluded, the probability of its presence in the lung and spleen is small.

* * * * * * * *

Besides the above examinations made since the last Biennial Report was issued, there should be reported from the laboratory the following experiments, which were conducted in 1896, but which were inadverently omitted from previous reports:

Shortly after the first work done in the laboratory on the Widal reaction for typhoid fever in man, an attempt was made to determine whether a serum reaction existed for hog cholera. A pure culture of *B. choleræ suis* was inoculated into the ear vein of a half grow male rabbit, Dec. 5, 1896, and blood was collected twice daily thereafter and the reaction tested. No reaction was present in the serum at any time during the 48 hours that the rabbit lived. At autopsy of the rabbit the inoculated bacteria were recovered from the liver, spleen, lung and heart's blood.

Dec. 5, 1896, an eight-months-old male guinea pig was inoculated subcutaneously with 1 c. c. of a 24-hour broth culture of *B. choleræ suis*. A specimen of blood taken previous to the inoculation showed no reaction. Blood was tested again as follows:

December 6th, at 11 a. m.—Reaction absent.
December 7th, at 6 p. m.—Reaction absent.
December 8th, at 10 a. m.—Reaction slight.
December 9th, at 10 a. m.—Reaction present.
December 10th, at 9 a. m.—Reaction present.
December 11th, at 4 p. m.—Reaction present.
December 12th, at 5 p. m.—Reaction present.

Animal died during night of December 12th. At autopsy B. *choleræ suis* was obtained from the site of inoculation, kidney, spleen, lung, liver and heart's blood.

Dec. 16, 1896, blood was collected from eight apparently normal hogs at the Stock Yards in St. Paul. This blood was tested with a pure culture of *B. choleræ suis* with negative results in each case.

Pressure of other work at this time and inability to secure blood from hogs suffering from hog cholera prevented the continuance of these experiments, and Feb. 20, 1897, Dr. Dawson, of the Bureau of Animal Industry, published in the New York Medical Journal a preliminary report on similar experiments.

During May, 1897, several specimens of blood from hogs supposedly affected with hog cholera were examined in the laboratory, but with negative results in each case. At the same time there were being conducted in the laboratory a series of experiments testing the virulence of *B. choleræ suis* from various sources on guinea pigs, rabbits, rats and mice. It was found in all of these experiments that were *B. choleræ suis* had been injected into laboratory animals that at autopsy the bacteria were present not only in the tissues and glands, but also in the blood stream. Therefore, despite the possibility of the development of a method of diagnosis by means of a serum reaction for hog cholera, experiments along this line were not continued because (1) a clinical diagnosis of hog cholera may be made with a fair degree of accuracy, and, (2) since the specific bacteria are present in the blood stream of infected animals the disease might possibly be spread from the blood during collection and transit.

Summary.—The laboratory work in connection with hog cholera and swine plague has been limited because there was little demand for investigation in connection with outbreaks of a disease in which the clinical diagnosis is readily made. In the matter of a curative or protective serum, work was not carried on extensively, since this matter has engaged the attention of the Bureau of Animal Industry for a number of years with relatively small return.

It was hoped in the event of the continuance of the study of infectious diseases of animals that light could be thrown upon this question in connection with the work on hemorrhagic septicæmia in cattle and swamp fever in horses. Collaboration between the veterinary department and the laboratory has, however, shown, so far as the investigations have been carried forward:

1. The usual association of swine plague and hog cholera bacilli, especially after the initial cases of an outbreak.
2. In certain instances swine plague bacilli only were found, particularly in initial cases.
3. In one instance* hog cholera bacilli were found in salted pork which had been responsible for severe gastric disturbances in human beings.
4. Experiments were early undertaken towards formulating additional means of diagnosis in the examination of blood of suspected cases for the agglutination test (Widal reaction).

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*State Board of Health Biennial Report, 1899–1900, p. 447.

TRICHINOSIS.

But little opportunity has been given for the study of this disease in Minnesota. A few recorded facts, however, are of interest.

During December, 1900, and January, 1901, a family of Germans, consisting of father, mother, ten children, living on a farm in New Sweden Township, Nicollet County, and two married daughters, ate of sausage made from hogs raised on their own farm. The first symptoms of the disease appeared Dec. 19th. The disease was first diagonsed as trichinosis by Dr. W. A. Beach of Mankato, Dec. 29th, when he was first called to see the cases. There were eight severe cases of trichinosis in this family, five of which were fatal. Four others had mild symptoms of trichinosis, but recovered. The father, eldest daughter, and son were the first members of the family to become ill, and a few days later one married daughter also had mild symptoms of the disease. The eldest daughter, M., died Dec. 29th, the father died Jan. 1st, and one son, G., died Jan. 5th. The mother also died in January, and another son, F., Feb. 12th. The infection of this family undoubtedly came from their own hogs, which had been slaughtered Nov. 28, 1900. These hogs had been raised and fed on the farm. So far as external evidence demonstrated the animals were all in good flesh and health at the time of slaughter. The family ate of the sausage made from these hogs as early as Dec. 3rd. The source of infection of the hogs was in all probability from rats, which were very numerous about the barns. The pen in which the hogs were fattened was within ten yards of the corn crib, and twenty yards of the barn.

The attention of the State Board of Health was first drawn to this family under date of Dec. 31, 1900. On the evening of Jan. 1, 1901, Dr. Wilson, bacteriologist from the State Board of Health Laboratory, in company with Dr. W. A. Beach of Mankato, visited this family. An autopsy was made on the body of the father, who had been dead twenty-four hours. No gross lesions were found in any of the organs except marked softening and flabbiness of the heart muscle, apparent fatty degeneration of the liver and small ecchymotic areas on the surfaces of the spleen and kidneys. The spleen, left kidney, portion of the right lung, apex of heart and portions of muscles from the left rectus of the abdomen, the diaphragm, intercostal muscle from fifth inter space (right side), larynx, right biceps and right quadraceps extensor, together with enlarged retroperitoneal glands were collected and brought to the laboratory. A piece of summer sausage from the same lot as that eaten by the family was also brought to the laboratory.

The autopsy was made under extremely difficult conditions in a small room, badly lighted by a single kerosene lamp and crowded with neighbors, who had to remain in the room on account of the intense cold out of doors. From the history, symptoms and autopsy findings, a provisional diagnosis of trichinosis was made at the time and the quarantine which had been imposed on the supposition that the cases were small pox was raised. Owing to the extreme cold, the excited condition of the numerous neighbors who had flocked to the house, and the necessity of economizing time as much as possible in order to reach Nicollet for an early morning train, specimens for routine blood examinations were not collected.

Within two hours after Dr. Wilson arrived in the laboratory with the specimens, January 2nd, a verification of the diagnosis of trichinosis was made by microscopic examination of the tissues collected at autopsy, numerous trichinæ being found in the specimens of muscle from the various sources noted above. Later examination of portions of muscle selected from the sausage also showed encysted trichinæ spiralis.

Another death from trichinosis occurred in a child two years of age in Waldon Township, Polk County, Oct. 5, 1902. The attention of the board was not drawn to this case, and it therefore received no investigation.

Mankato, Minn.—Four specimens of pork forwarded by Aug. C. Arneman, No. 324 E. First Street, Mankato, Minn., to Dr. Bracken, on Feb. 11, 1901, were received in the laboratory February 14th. Three small pieces of pork were contained in the packet, which was accompanied by a letter from Mr. Arneman requesting an examination for trichinæ. This was made, but no trichinæ were found.

Sandstone, Minn.—Jan. 7, 1902, there was received in the laboratory by mail, through Dr. M. H. Reynolds' office, a package containing pork. This had been sent by Dr. D. W. Cowan, accompanied by the following letter:

Sandstone, Minn., Jan. 1, 1902.

Dr. N. M. Reynolds, Secretary State Veterinary Board, St. Anthony Park, Minn.

Dear Sir: I have forwarded you to-day a sample of pork which was brought me, and the party bringing it said he had reasons of suspecting trichina being present.

Have forwarded the sample to you, as I do not know what else to do with it

Respectfully,

D. W. COWAN, H. O.,
Sandstone, Minn.

The sample of pork was dry and covered with mould, having been simply wrapped in several thicknesses of paper and forwarded. Thin sections were cut from various portions of the lean pork sent and examined in glycerine with low power objectives. No trichinæ were found.

New Ulm, Minn.—Feb. 5, 1903, there was received in the laboratory a sample of pork. Concerning it the following letter had been received two days previously:

Dear Dr. Wesbrook: I send you by this mail a sample of pork for examination as to the presence of trichina. The sample was brought in by a farmer.

Fraternally yours,

A. F. STRICKLER.

On its arrival the specimen was carefully examined and no trichinæ found.

Hutchinson, Minn.—May 23, 1903, there was received in the laboratory a specimen of pork accompanied by the following letter:

Hutchinson, Minn., May 21, 1902.

Dear Sir: You will find enclosed a sample of cooked pork, which I believe to be infected with trichina, that bane of mankind. Will you kindly subject it to a critical test and mail me the results of your investigation? I obtained the sample from some meat that was used at my hotel.

Yours sincerely,

EBEN E. BUTLER.

The specimen consisted of a fragment of cooked meat. It was examined by teasing out portions of the dry muscle in glycerine and examining microscopically. Nothing resembling trichinæ spiralis was found.

LABORATORY REPORT ON SUNDRY OBSCURE DISEASES OF SWINE.

Hugo, Minn.—May 25, 1901, Drs. Brimhall and Wilson visited the farm of Mrs. Wilcox near Hugo, to investigate the cause of death of one pure bred hog. Unfortunately the animal had been cut open by the hired man and had been exposed so long to the air that an examination of the carcass was useless. From the history of the case it was possible to say positively that the disease was not hog cholera and as this was what the owner was especially in fear of, this assurance was appreciated. Later this opinion proved to be well founded as nothing further developed in the herd.

May 29, 1902, Dr. Brimhall again went to Mrs. Wilcox's farm to investigate a disease among pure bred hogs which was supposed to be of an infectious nature. Only one animal was found affected and this was not in a serious condition.

West Concord.—April 2, 1902, there was received in the laboratory a specimen accompanied by the following letter:

> West Concord, Minn., April 2, 1902.
>
> Dr. F. F. Wesbrook, Minneapolis,
>
> Dear Doctor: I send you by express today a portion of the large intestine of a hog. The hog had every appearance of being all right, but the farmer owning the same is afraid of the meat on finding the bowel on this condition. Can you tell the cause of this condition? Will the meat be fit to eat?
>
> Yours fraternally,
> E. E. HARRISON.

The specimen consisted of a small portion of the small intestine of a hog, placed in a diphtheria box without any packing. It was examined macroscopically by Dr. Brimhall and the laboratory staff. The intestine was unopened and attached to it was a piece of mesentery. On the peritoneal surface of the intestine were numerous smooth bullæ or gas bubbles, some of which appeared to be in the mesenteric tissue. There was some congestion and possible œdema of the bowel also. It did not seem possible that manipulation could have created an interstitial emphysema such as this appeared to be. The lesion may have been due to *B. coli communis* or to some ærobic gas-producing bacillus. The specimen was in no condition to examine macroscopically or bacteriologically and an accurate diagnosis was out of the question.

Long Lake, Minn.—Jan. 11, 1903, Mr. F. R. Hubachek, whose farm is near Long Lake, Minn., sent to the laboratory a pig, one of three which had died on his place. The symptoms first noted were fainting spells from which some of them would apparently recover after being rubbed. They were noticed bleeding a little from the nose after the spells. They exhibited these symptoms for a week before they died.

The one that was received in the laboratory was partially frozen and in very good condition. An autopsy was made at once by Drs. Brimhall and Wilson. There were no lesions indicating either swine plague or hog cholera or any other specific disease. The lungs were slightly congested, probably from hypostasis. One post pharyngeal gland was slightly hæmorrhagic but not enlarged.

Direct coverslip preparations and broth and serum cultures from both lungs and spleen showed no bacteria. It was the opinion of Dr. Brimhall that the pigs were dying from close crowding coupled with heavy grain feeding.

St. Cloud Reformatory, St. Cloud, Minn.—On March 20, 1903, there was received in the laboratory a two-quart glass jar containing a large portion of liver in a mixture of formaldehyde and alcohol. Accompanying the specimen was the following letter from Dr. O. H. Wolner of the St. Cloud Reformatory:

St. Cloud, Minn., March 13, 1903.

Dr. Wilson, Minnesota University, Minneapolis,

Dear Doctor: Enclosed please find a specimen of liver taken from a boar which apparently died suddenly, but of course did not, as the postmortem findings showed, which are as follows:

Kidneys apparently normal.

Lungs and heart normal.

Spleen enlarged, friable and congested, of a black appearance.

Intestines showed peritonitis but not inflammation of the mucous membranes.

Peritoneal adhesions between the coils of the intestines (small).

Between the peritoneum and the peritoneal fat were four or five cysts containing a clear, gellatinous fluid; in the immediate vicinity were numerous adhesions and three small localized abscesses.

Liver.—The liver was greatly enlarged and extremely friable and covered with small white areas which when opened seemed to be air spaces. Peritoneal fluid was normal in amount.

We have had fifteen hogs die of the same disease, and if you could enlighten us we would be greatly obliged to you. In some of the hams that were cured last fall localized abscesses in the lympathic glands were found.

I am, dear doctor,

O. H. WOLNER, M. D.

The liver specimen received in the laboratory presented on section a markedly honeycombed appearance. A portion of it was imbedded in celloidin, cut and stained with hæmatoxylin and eosin and eosin-methylene blue. The bacteria appeared to be well preserved but the tissue poorly preserved. This would indicate that considerable post-mortem change hand occurred before the tissue was placed in fixative. The honeycombed appearance of the tissue was apparently due to the destruction of the central lobule and the formation of a large amount of gas by some bacterium which pressed the remaining portion of the tissue to the periphery of the lobule. It was impossible to determine from the specimen whether this was post-mortem or not.

There were apparently two species of bacilli present in the tissue. One, a small bacillus, probably *B. coli communis*, and the other a large spore-bearing, probably a putrefactive bacillus. It was impossible to identify these positively from a simple macroscopic examination.

March 25, 1903, there was received in the laboratory by express, two pigs from the Minnesota State Reformatory, St. Cloud, Minn. These had been sent at the request of Dr. Brimhall and were accompanied by the following data:

"There were 250 hogs in the herd at the Reformatory when the trouble began in January last. 30 showed the disease; some have been condemned for slaughter and killed. The sick animals eat well and die without pain. There are abscesses on the exterior in some cases."

On March 26, 1903, an abscess was opened on the smaller of the two pigs and direct coverslip preparations and cultures were made. The abscess was about one and one-half inches in diameter, filled with cheesy pus.

Direct coverslip preparations and cultures in broth and on serum showed only streptococci present.

These hogs were kept in the laboratory of Animal Research and in a few weeks recovered from the skin abscesses without treatment. They appeared to be in perfect health and were used later for experimental inoculation in connection with the study of swamp fever.

HÆMORRHAGIC SEPTICÆMIA IN CATTLE.

Since August, 1900, this board has had to give attention to numerous outbreaks of hemorrhagic septicæmia in cattle, a disease which, while well known in Europe, Asia, Africa and South America, had prior to the investigations of this board been recognized but once as occurring in North America. The high mortality of the disease in animals of such value as cattle, the rapidity of its spread in herds and a possibility of the infection of animals other than cattle makes the disease one of great importance from a public health standpoint. The subject was deemed of such vital interest that after the publication of a preliminary report in the Journal of Comparative Medicine and Veterinary Archives, December, 1900, this board issued a special bulletin in January, 1901, describing the disease as it had occurred in Minnesota up to that date, and recommending measures for the prevention of its spread. This bulletin was afterward republished in the biennial report for 1899-1900, q. v. This report gives the result of the investigations on the first 64 cases of the disease.

At the meeting of the American Veterinary Medical Association at Minneapolis, Sept. 2, 1902, Dr. S. D. Brimhall read a paper on "Hemorrhagic Septicæmia in Cattle," in which he gave some account of the work done subsequent to Jan. 1, 1901. This paper is published in the proceedings of the Association, page 302, and also in the American Veterinary Review for May, 1903, page 103.

*For a history of the early outbreaks of the disease in Minnesota, for symptoms, pathological and bacteriological findings and early experiments in vaccination, the reader is referred to the above mentioned papers.

In order to give a clear idea of the work done subsequent to that reported above it seems advisable to present a detailed statement of

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*In addition to the above mentioned publications, Dr. M. H. Reynolds, formerly a member of this board, published in the American Veterinary Review for December, 1902, and January, 1903, an article describing (1) outbreaks Nos. 4 and 7 which had already been described in the bulletin of this board in January, 1901; (2) an outbreak near St. Michael's Station, Wright county, where on two farms eleven animals were lost. This outbreak was never officially reported to the State Board of Health. (3) Outbreak No. 75, reported in this paper, and (4) several suspected outbreaks near Faribault, Monticello, Belle Plaine and elsewhere. This board received no information concerning any of these suspected outbreaks at the time of their occurrence and consequently was unable to make any investigation of them. The diagnosis of these suspected outbreaks remains in doubt.

the field and laboratory examinations followed by a summary. A reference to the accompanying map showing the location of outbreaks by counties, will be of aid in following the description.

HISTORY OF OUTBREAKS FROM WEEKLY REPORTS OF VETERINARIANS AND FROM LABORATORY RECORDS.

†*Outbreak 9—Clearwater, Wright County.*—Jan. 8, 1901, Dr. Brimhall went to Clearwater, Wright county, to investigate cause of death of four head of cattle belonging to Mr. J. M. These cattle had died a few days before and were badly frozen so that it was impossible to make an autopsy, but from symptoms described by the owner, Dr. Brimhall was satisfied that death was due to hemorrhagic septicæmia.

Blunt, South Dakota.—Aug. 15, 1901, Dr. Brimhall went to Blunt, S. D., to assist Dr. Foster, state veterinarian, in the investigation of supposed anthrax in cattle. In the vicinity of Blunt he visited a number of ranches where many cattle had died, 100 head having been lost on one section. On the farm of Mr. E., who had lost more than 30 head, one case was found which had been sick four weeks. The animal was very thin and the owner was persuaded to permit her to be killed for purposes of autopsy. On opening the animal a few small hemorrhagic areas were found on the spleen, kidney, liver, lung and mediastinal glands. There was also some inflammation of the lungs. Swab cultures were taken from the heart's blood and from a hemorrhagic œdematous knee. No animals recently dead of supposed anthrax were found, but a portion of skin was removed from the carcass of one (Case b) which had been dead six or eight weeks and over which lime had been sprinkled. Cultures and a portion of skin were brought to the laboratory August 20th.

(a) The piece of skin was soaked for 20 minutes in 40 per cent alcohol and thoroughly washed in several changes of the same. It was then removed with sterile forceps and washed through several changes of plain broth, 500 c.c. in all being used. After all precipitation had ceased and all lime had apparently been removed, the tissue was dropped into an Ehrlenmeyer's flask containing 500 c. c. of plain broth and placed in the incubator.

(b) Direct coverslip preparations were made from the various swabs and organs in this case and stained with eosin and methylene

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†Outbreaks Nos. 1-8 are described in the bulletin issued January, 1901. See pp. 374-397, 18th Report Minn. State Board of Health.

blue. They showed quite abundant ovoid, belted bacilli morphologically identical with *B. bovisepticus.*

A few sarcinæ were present in the smear preparations from the swab from the knee joint.

Cultures were made from the various swabs and organs received, into the water of condensation of Löffler's blood serum and broth.

A flask of broth inoculated with the bit of skin (specimen A) after 36 hours in the incubator was found to contain two forms of large spore-bearing bacilli. Twenty-four hours later two varieties of colonies appeared. One was a small pasty looking colony which did not liquefy the serum and which was composed of rather large oval shaped spore-bearing bacilli with rounded ends. The other variety of colonies had irregular edges, somewhat rough looking over the surface on both media and were beginning to liquefy the serum. Microscopically, the bacilli from these colonies were B. anthracis. From single colonies sowings were made in and on the various culture media and especially a hanging agar drop culture (by the Wesbrook method). An emulsion was made with broth from the colonies on the surface of one of the agar slant streakings which appeared to be composed mostly of the anthrax-like organism and .05 c.c. of the emulsion inoculated subcutaneously into the groin of guinea pig No. 452, weight 752 grams. Twelve hours later this animal showed marked swelling and œdema without crepitation at the site of inoculation and in the neighboring abdominal region. At autopsy intense œdema of the region noted above was found present. The spleen was much enlarged, black and very soft. From it a pure culture of B. anthracis was obtained as well as numermous smears, which, stained with eosin and methylene blue, showed the presence of no other micro-organisms.

Thirty hours before the death of the guinea pig, i. e., six hours after the preparation of the hanging agar drop culture, a diagnosis was made, with a reasonable degree of certainty, from a microscopic examination of the hanging agar drop culture. The diagnosis in this case was anthrax.

Specimens noted under (*b*). Examination after 36 hours in the incubator of cultures from the heart's blood, spleen, lung and two glands showed pure cultures of *B. bovisepticus.* Cultures from the swabs from the knee joint showed *B. bovisepticus* in great abundance and sarcinæ. Cultures from one of the affected glands, from the kidneys and the liver gave no growth. No other micro-organisms than those noted above, namely *B. bovisepticus* and sarcinæ, were found in any of the direct coverslip preparations or cultures. The diagnosis in this case was hemorrhagic septicæmia due to *B. bovisepticus*, whilst that noted under (a) was anthrax.

Note.—Though chronic forms of hemorrhagic septicæmia due to bacillus bovisepticus have been noted by other observers, this was the first instance met with in the experience of the Minnesota State Board of Health.

Outbreak 10—*Ham Lake, Anoka County.*—Aug. 21, 1901, Drs. Brimhall and Wilson visited the farms of Mr. N. P. and Mr. A. B. and made a complete post-mortem examination of an animal, the property of Mr. N. P., dead eight hours previousily, and a superficial examination of a steer, the property of Mr. A. B., dead nine hours previously.

The following history of the outbreak was obtained:

About two weeks before, or August 8th, a herd of cattle, ten of which belonged to Mr. P. and four of which belonged to Mr., B. all running together in the same low pasture (wild land) began to show evidence of sickness. Up to August 21st, 12 of the 14 head had died. They all exhibited similar symptoms and died in from one to four days after becoming ill. The animals first began moping, attempting to eat and drink but not successfully. Most of them showed some hemorrhage from the nose and rectum and finally very quickly dropped down and died. The animal first examined, the property of Mr. P., exhibited perfect lesions of hemorrhagic septicæmia, enormous hemorrhages being present under the skin, throughout the muscles and fascia and throughout all of the internal organs.

Cultures were taken from various hemorrhagic areas, heart's blood and spleen. These cultures on examination in the laboratory revealed *B. bovisepticus* in pure culture except in the specimen from the spleen which showed, in addition, a small, motile bacillus irregular in shape, which when isolated proved to be *B. coli communis.* (The animal had been dead eight hours before autopsy was performed and some decomposition had of course, set in).

Owing to lack of time, the animal dead nine hours previously, the property of Mr. B., was examined, but superficially. The skin was removed from the neck where large hemorrhagic areas with œdema were found present. No cultures were taken from this animal.

A diagnosis of hemorrhagic septicæmia was made at the time of making the autopsies.

Outbreak 11—*Bradford, Isanti County.*—Aug. 29, 1901, Dr. Annand and Wilson visited the farm of Mr. J. W. B., Bradford P. O., Minn., and made an autopsy on one animal killed for purpose of autopsy. The history of the outbreak obtained from Mr. B. in brief was as follows:

About three weeks ago this herd of cattle, 12 in all, consisting of cows and young stock which were running in a wild pasture containing a large swamp, began to exhibit symptoms of disease. They moped about, had difficulty in swallowing, bled from the nose and passed bloody fæces and urine. They rapidly grew worse and died in from twenty-four hours to four days. They dropped off, one by one, until six had died and two were ill at the date when the farm was visited. One of the animals, a three-year-old, small black cow which had been ill for three days, was killed by a blow on the forehead and immediately examined. Hemorrhagic areas from pin point to two inches in diameter were found scattered through the subcutis and in the tissue about the udder. Similar hemorrhagic areas, though much larger in extent, were found in the internal organs; the first stomach, pericardium, heart wall and gall bladder being particularly affected. The gall bladder was very much distended and two-thirds of its wall dotted with very black hemorrhagic areas from pin point in size to one-half inch in diameter. This was preserved as a gross specimen by being placed immediately in 10 per cent formaldehyde and five hours later in Kaiserling's fixative.

Cultures were taken from the pericardial fluid, heart's blood and spleen. After 48 hours in the incubator, cultures from the pericardial fluid and heart's blood showed abundant growth and from the spleen scant growth of *B. bovisepticus* apparently in pure culture in all of the tubes except one serum tube inoculated from the pericardial fluid. This contained one yellow colony, which on microscopic examination proved to be sarcinæ, apparently a contamination introduced at the time of making the culture.

Outbreak 12—*Kellogg, Wabasha County.*—Sept. 19, 1901, Drs. Annand and Wilson visited the farm of Mr. T. G., four miles west of Kellogg, Minn., and made an autopsy on the body of a six months old calf, dead twenty-four hours previously.

Two weeks before, or about September 5th, one of Mr. G's. yearling cattle, which was running in a low pasture in the Zumbro river bottom, was noticed sick. The animal was placed in a wagon and hauled to the barnyard where it died some six hours later. It was skinned where it died, then hauled to a field near by and buried.

The other cattle, including the herd in which the first animal became sick and several cows running in another pasture, were all brought into this barnyard at night. About 10 days later, or September 16th, two head of young stock became sick and died within 24 hours. The following day two others became sick. One died the same day, the other lived until the morning of September 18th. This was the animal on which the autopsy was made. The weather was cold, frost having occurred on the night of September 16th, and a cold rain was falling but decomposition was much advanced when the animal was examined. The body was much distended with gas. Some hemorrhagic arears showed about the udder and groin resembling those of "black leg" and contained, along with the other portions of the body, some gas bubbles. Numerous hemorrhagic areas, however, were found about the shoulder, in the heart wall and scattered throughout the internal organs generally, which contained no gas bubbles.

Direct coverslip preparations and cultures were made from the hemorrhagic udder, from the hemorrhagic areas about the shoulder, the heart's blood and spleen. These all presented on microscopic examination an admixture of

(a) A large spore-bearing aerobic bacillus which grew best at room temperature and very slightly at incubator temperature.

(b) *B. coli communis.*

(c) *B. bovisepticus.*

Apparently no other micro-organisms were present in the coverslip preparations or cultures.

Mr. G. was directed to clean up his place with fire and lime and report further cases of the disease if any occurred.

Outbreak 13—*State Experiment Station, Ramsey County.*—On the morning of Oct. 4, 1901, a Jersey heifer, aged two years and three months, in good general condition, at the State Experiment Farm was noted to be bellowing in an unnatural manner and having a wild, unnatural expression of the eyes. The animal was not vicious. Her temperature was a rather low, normal, 99.8. The muscles of the face and neck were almost tetanic. Head drawn back towards shoulders and slightly upward. Neck thus appeared much shortened. Facial muscles were drawn so as to give a peculiarly pointed appearance to the upper lip. In the afternoon of the same day the skin was noted to be no longer sensitive over any portion of the body except ears and nose, where it was slight. Gradually the nervous condition passed away, the bellowing became less violent and less frequent and the heifer became moderately dull. She remained standing all of October 4th and 5th and died late on the evening of the 5th. There had been no apparent pain at any time. The spine had not been sensitive to pressure at any time. The animal was found dead on her back on the morning of October 6th. The head was immediately removed from the body, packed in ice and sent to the laboratory.

October 6th, Dr. M. H. Reynolds made an autopsy on the remainder of the body. He found some hemorrhagic areas within the internal organs, especially marked on auricles of the heart. One large hemorrhagic area was also present over the hock.

In the laboratory on removing the skin from the head, a very large hemorrhagic area was found below and back of the right ear. This was infiltrated with bloody serum and caused external swelling. A bruise apparently from a blow was also present on the pole of the cranium and above the right ear. The vessels of the meninges of the brain were congested and several small, apparently hemorrhagic areas from one-eighth to one-fourth inch in diameter were present on the surface of the brain, particularly on the dorsal surface of the left frontal lobe and the ventral surface of both hemispheres of the cerebrum. One or two minute hemorrhages were also found deeper in the brain substance at the junction of the white and gray matter on section of the cerebral hemisphere.

Direct coverslip preparations from the brain and from the hemorrhagic area back of the ear showed a number of diplococci. Mixed with these in the direct coverslip preparations from the hemorrhagic areas were bacilli which morphologically were indistinguishable from *B. bovisepticus*. Cultures showed the diplococci to be *diplococcus pneumoniæ*, and the bacilli to be *B. bovisepticus*.

Outbreak 14—*Kilkenny, Le Sueur County.*—Nov. 1, 1901, Dr. Annand visited the farm of Mr. D. near Kilkenny, Minn., and held an autopsy on a cow that had died suddenly after having been feeding on standing corn stalks for several days with a number of other cattle. The animal was milked the previous night and was apparently in perfect health, but was found sick in the morning when the owner went out to milk her, and was unable to rise, and died about 11 a. m. A few hemorrhagic lesions were present but not sufficient to warrant a diagnosis of hemorrhagic septicæmia. Portions of spleen, lung and the whole of the heart were brought to the laboratory November 2.

Direct coverslip preparations showed small diplococcoid belted bacilli from the spleen and lung. Broth and serum cultures from the same source and from the heart's blood, developed similar bacteria. A diagnosis of hemorrhagic septicæmia was made.

Outbreak 15—*Candota Township, Todd County.*—Nov. 20, 1901, Dr. Brimhall went to Sauk Center and visited the farm of Mr. D., who lives six miles from Sauk Center in Candota township, Todd county. Mr. D. had lost five head of cattle within a week out of a herd of eighteen. Two animals in the same herd were suffering with foul in the hoof. Dr. Brimhall made an autopsy on two animals which were dead and unburied. One had been dead 24 hours and the other 72 hours. At autopsy the lesions of hemorrhagic septicæmia were found. Dr. Brimhall instructed the owner as to disinfection, etc. He learned that another farmer southwest of Sauk Center had lost seven head of cattle with probably the same disease. People in the vicinity had considered the trouble due to corn stalk disease.

Owing to the advanced stage of decomposition in which the animals were found no specimens were procured for bacteriological examination.

Outbreaks 16-65—*Worthington, Nobles County.*—Nov. 26, 1901, Drs. Brimhall and Wilson visited the farm of Mr. W., four miles northeast of Worthington, Minn., and made an autopsy on the body of a yearling heifer which had died eight hours previously, after twenty-four hours illness. This was the third animal to die on the place within a week and the outbreak was one of twelve similar ones occurring in the vicinity during the current month.

The animals in all of the herds had been running in standing corn. They sickened and died suddenly. They had been seen by Dr. Gould or his assistant, Mr. Potts, a third year veterinary student. A diagnosis of corn stalk disease had been made from the history on all of the cases, though Dr. Gould, who had seen the demonstration of hemorrhagic septicæmia at the meeting of the State Veterinary Society in January, 1901, said he knew that the disease which he had formerly diagnosed as corn stalk disease, and which was the same as present in these outbreaks, was identical with hemorrhagic septicæmia in history, in symptoms and lesions. Dr. Gould and Mr. Potts had made post-mortem examinations of several of the dead cattle. Dr. Gould reported at this time 15 outbreaks in Nobles county and 35 in Jackson county, with a mortality of about 200 head of cattle in all.

The animal examined by Drs. Brimhall and Wilson was in a good state of preservation. On removing its skin, large hemorrhagic areas were found over the neck, involving the subcutaneous tissue and superficial muscles and the pre-scapular and cervical glands. The lungs exhibited collapsed areas, one to three inches in diameter, of typical "swine plague" variety. The heart wall exhibited numerous small, intense, sharply outlined hemorrhagic areas. Hemorrhagic areas were scattered along the alimentary canal, especially in the third stomach. The liver, spleen, kidneys and urine were normal.

Coverslip preparations and broth and serum cultures were collected from the usual sources.

Coverslip preparations from all sources except the pericardium showed *B. bovisepticus.*

Broth and serum cultures, except from the pericardium, showed *B. bovisepticus.* One culture from the spleen showed large bacilli, possibly a contamination. The pericardium showed no growth. *B. bovisepticus* isolated from this case proved of high virulence. Thirteen rabbits when inoculated with minute doses all died in from four to eighteen hours after inoculation.

Outbreak 66—*Dalbo Township, Isanti County.*—Feb. 11, 1902, Dr. Annand went to Dalbo township, Isanti county, to investigate an outbreak of contagious disease in the herd of Mr. R. He was informed that cattle had been dying since November, and that up to the present time Mr. R. had lost forty-one head out of about 275. Some had died suddenly without having appeared ill. Some had lingered for two weeks. The only clinical symptom was weakness. They remained standing until they died, but seemed to be paralyzed behind, so that they were not able to get up, if down. Three cattle were found which were not well. One which seemed worse than the others was killed and post-mortem held. On removing the skin on all four limbs from the knee to the hoof marked hemorrhagic areas were present, also a plastic exudate under the skin on neck and over the pectoral muscles. A front limb was removed from the body, and a plastic exudate below the attachment of the serratus magnus muscle was found. The ribs from the left side were then removed and a plastic exudate on the pleura was found, both pleura and lung being apparently partially organized. The lobe of the left lung was hemorrhagic. One small hemorrhagic area was present in small intestines. A deposit of plastic exudate encircled the kidneys. The spinal cord in the lumbar and cervical region had a plastic exudate encircling it. This probably was the cause of the paralysis. From post-mortem lesions the owner was told that he had an outbreak of hemorrhagic septicæmia. He was advised to clean out all his sheds and disinfect thoroughly, and if possible to build new yards and feeding racks and put the healthy cattle in the new one, and remove as soon as possible those which should become sick from time to time.

March 18, 1902, Dr. Annand, with Dr. Wilson, again visited the farm of Mr. R. and examined and made an autopsy on the body of a yearling heifer. The animal became sick on March 15th, being down when found. When helped up it was able to walk, but soon fell. It was able to eat and drink and seemed suffering no pain. There was considerable swelling about the ankles. This was still the condition of the animal when seen at 3 p. m., March 18th. The temperature was 100.4. The animal was killed, and a post-mortem made.

There were abrasions about the ankles of both posterior extremities. Hemorrhagic areas on the fetlocks, knees and hocks were found. A few small hemorrhagic areas were present on the neck. The lungs showed one collapsed area about one by two inches in diameter. The fat about the heart was infiltrated with a yellow gelatinous exudate. One small hemorrhagic area was found in the mesentery near the beginning of the rectum. The omentum covering the kidneys contained considerable yellow gelatinous exudate. The other internal organs appeared normal. The spinal canal was completely filled with a yellow gelatinous exudate. No such material was found in the cranial cavity.

Cultures were sown from the usual sources. Portions of lung, heart wall, liver, spleen, the whole of the right kidney and portions of the spinal cord from the lower lumbar, mid-dorsal, and upper cervical regions and of the brain were preserved for histological study.

The cultures from the heart's blood, lung and spinal cord showed *B. bovisepticus* in pure culture. Those from the pericardial fluid showed no growth.

Outbreak 67—*Milaca, Mille Lacs County.*—Feb. 12, 1902, Dr. Annand visited the farm of Mr. W. P., 38 miles north of Milaca, Mille Lacs county, and investigated an outbreak of disease among cattle. Eighteen of the animals had died since January 1st, and one was at the point of death at the time. The herd originally contained 125. Clinical symptoms and post-mortem lesions were almost identical with those in cattle on Mr. R's farm in Dalbo township. The sick animal was killed and an autopsy made. Hemorrhagic areas were found over all the lower portions of the limbs. A yellow plastic exudate was present on the neck under the shoulder blade, around the kidneys, covering the pleura and surrounding the heart. A number of small hemorrhagic areas were present on small intestines. A yellow plastic exudate surrounded the spinal cord in both lumbar and cervical regions and was continued upward to the base of the brain. A diagnosis of hemorrhagic septicæmia was made. The owner was advised to build a new feeding rack and yard at some distance from the present one, to remove all the apparently perfectly healthy cattle to the new lot, to clean and disinfect one old shed for the sick ones to remain in, and to separate all the sick as soon as they appeared in the healthy herd.

On March 19, 1902, a communication from Mr. P. stated that he had up to that time lost thirty-five head of cattle. April 9th he wrote again saying he had lost forty-five head, and that he proposed trying blackleg vaccine on the remainder. The vaccine was sent him and he used it about April 15th. April 28th he wrote again saying that after vaccinating his cattle twenty more had died, thus making a total of sixty-five head out of his herd of 125.

Outbreak 68—*Gordon Township, Todd County.*—March 26, 1902, Dr. Brimhall visited the farm of Mr. J. in Gordon township, Todd county. Mr. J. had lost four head of cattle since Christmas and five others were sick. The animals all became ill suddenly. The first symptoms were unsteadiness in walking and turning. This weakness rapidly increased until the posterior extremities were so paralyzed that the animals were unable to stand and had to be helped up. At first they were able to walk after once rising. They grew gradually weaker and emaciated, though the appetite remained good to the last. Two died in less than a week, one lived four weeks and one six. The temperatures of the five sick animals were from one to two degrees below normal.

One, a cow, which had been dead about 36 hours, after six weeks of sickness was examined. Post-mortem changes were quite marked and obscured hemorrhagic lesions which may have been present in the internal organs. Under the skin were found a number of hemorrhagic areas. The significance of these was somewhat masked by the fact that considerable bruising had occurred during the animal's long illness. A portion of the spinal column containing spinal cord was brought to the laboratory March 27th. Direct coverslip preparations from the meninges of the cord showed many bacteria, including small belted ovoid bacilli, long colon-like bacilli and large spore-bearing bacilli.

Cultures on serum and in broth gave an abundant growth from which were isolated *B. bovisepticus*, *B. coli communis* and a larg spore-bearing putrefactive bacillus.

Outbreak 69—*Osakis, Douglas County.*—March 26, 1902, while Dr Brimhall was engaged in investigating the outbreak of hemorrhagi septicæmia noted above in Gordon township, Todd county, a liveryman at Osakis informed him that his (the liveryman's) cow a few months before had gotten sick, first showing a swelling on the brisket then on the fore legs about the ankle joints, growing rapidly emaciated and dying after about three months' illness. On skinning her he had found many bloody spots under the skin.

On considering this case in relation to the outbreak at Mr. J's. above noted, Dr. Brimhall was of the opinion that the case might have been one of hemorrhagic septicæmia. While nothing positive can be asserted as to the diagnosis, the case seems to be worthy of record.

Outbreak 70—*Brooten, Stearns County.*—On the 24th of April, 1902, Dr. Brimhall visited the farm of Mr. O. S., four miles southwest from Brooten, Minn. Mr. S. originally had 12 head of cattle. Two died about a week ago and four were sick at the time of Dr. Brimhall's visit. Three of them were unable to get up. The temperatures of these animals were taken. The two which were killed later had a temperature of 98½°. A cow that was still able to get up had a temperature of 102°, and a calf which was unable to get up, but frequently endeavored to do so, had a temperature of 104°. The owner said they did not eat well and some of them he had noticed being lame. The cow that was down was breathing heavily; had been able to get up and down until that morning. There was some discharge from her nose.

The cow and steer calf were killed and autopsies made at once.

The cow showed one small hemorrhagic area on the inner side of the hock joint, but no others were found on the side from which the skin was removed excepting a large area on the neck, but this was caused from the operation of bleeding which was done a few days previously. The internal organs showed no change except the spleen, which was much enlarged; the pulp was very dark and soft and showed a few small, hemorrhagic areas. After opening the abdomen in a short time the spleen shrank to nearly half its original size. The spinal cord showed marked exudate and considerable fluid ran out as the spinal column was sawn into. After burning off the spleen, swabs and cultures were taken and from the spinal canal without burning. Broth and serum were inoculated at once. A portion of the spleen was cut out and brought to the laboratory in a sterile bottle.

The steer calf showed no hemorrhagic lesions under the skin except in the flank and groin. These were very marked on both hind legs. The internal organs showed no change excepting the lungs which were congested and showed a few small hemorrhagic areas. The spinal cord showed a marked exudate with bloody serum. Cultures were taken from the spinal cord and from the hemorrhagic areas and inoculated into broth and serum. In the laboratory, cultures on various media showed spore-bearing bacilli, small motile bacilli, staphylocci and a few small diplococcoid non-motile bacilli morphologically *B. bovisepticus.* The latter was not isolated in pure culture owing to the enormous overgrowth of the other organisms.

Outbreak 71—*Little Falls, Morrison County.*—April 25, 1902, Dr. Annand visited the farm of R. Bros. near Little Falls, Minn., to test the herd of cattle for tuberculosis. Three head of cattle had died out of a herd of about forty head. The sick ones had recently been brought from Iowa. On arriving at the farm one animal was found sick and unable to rise. Being suspicious that the cause of the disease was not due to tuberculosis Dr. Annand killed this animal and made a post-mortem examination. Marked lesions of hæmorrhagic septicæmia were abundant. Specimens were brought to the laboratory and *B. bovisepticus* isolated.

Outbreak 72—*Kimberly, Aitkin County.*—Early in April, 1902, Dr. J. G. Harris of Duluth called at the office of this board and in conversation with Dr. Brimhall described an outbreak of the disease among cattle on the farm of McR. Bros., near Kimberly, Aitkin county. From Dr. Harris' description of the onset, symptoms, etc., of the animals there seemed little doubt that they were suffering from hæmorrhagic septicæmia, some of them with the chronic type. A request was made for specimens to be sent to the laboratory.

On May 2, 1902, there was received in the laboratory two portions of spinal column containing spinal cord with a letter from Dr. Harris saying: "Mr. McR. of McR. Bros. has just telephoned me that he is sending you by express to-day portions of spinal column from two animals from his place. The larger piece (from the lumbar region, I believe) is from a young animal that had just died of the disease. The smaller piece is from an animal that was killed after having been sick some time. About sixty head of cattle have died on this place during the spring. In conversation with Drs.

Brimhall and Reynolds, some time ago, we concluded that the disease was hemorrhagic septicæmia."

The specimens when received in the laboratory were too much decomposed to permit the determination of any pathological lesion which may have been present. Direct coverslip preparations from the pia of the cord (central portion of the specimen) showed colon like bacilli. Cultures in broth on serum and agar showed only B. coli communis.

Granting that the disease was correctly diagnosed as hemorrhagic septicæmia, which seemed probable from Dr. Harris' description, either no lesions containing the specific bacteria existed in the spinal cord, or they were destroyed by the processes of decomposition, or masked by *B. coli communis.*

Outbreak 73—Huntersville Township, Wadena County.—May 21, 1902, Dr. Annand visited the farm of Mr. G., Huntersville township, Wadena county (near Park Rapids), and investigated an outbreak of infectious disease among Mr. G's. cattle. Mr. G. had originally about 25 cattle in his herd. Of these he had lost nine head. Six others had been sick. Five of these had recovered after three to six weeks illness. One, a cow, was still sick, but Mr. G. thought at the time that she was improving. The symptoms were those of a chronic paralytic type, such as described above. Several of the cows had, after becoming unable to rise, aborted. The beginning of their recovery seemed to date from the abortion. No material for autopsy was obtained, but from the history and the appearance of the one sick cow, a diagnosis of chronic hemorrhagic septicæmia was made.

Outbreak 74—Huntersville Township, Wadena County.—May 22, 1902, Dr. Annand visited the farm of Mr. H. H. in Huntersville township, Wadena county. Mr. H. had lost 12 head of cattle. Four others had been sick but recovered. One, a calf, was sick at the time of Dr. Annand's visit. The calf had been in a worse condition three days before, having been unable to rise, though he was able to get up of his own accord just before being killed. The animal was slaughtered by Dr. Annand and an autopsy made.

On skinning, one small hemorrhagic area was found on the left hind foot in the region of the inner cannon bone. On opening the carcass a yellow plastic exudate surrounded the kidneys. A small amount of the same exudate was present in the pleural cavity. The two anterior lobes of both lungs were much inflamed, being hemorrhagic in appearance and with some pus (?) formation. On section both kidneys showed a plastic exudate in the pelvis, and some cortical congestion. The spinal cord in the sacro-lumbar region and about the medulla was surrounded by a yellow plastic exudate. Specimens from the lung, heart, liver, kidney and spinal cord were collected and taken to the laboratory.

In the laboratory the cultures above mentioned showed from the lung, heart, liver and spinal cord *B. bovisepticus*. From the kidney, in addition to *B. bovisepticus* was found *B. coli communis*.

Outbreak 75—*State Experiment Station, Ramsey County.*—On Saturday, June 7, 1902, it was first noticed that eight head of cows in the State Experiment Station herd gave very little milk. On Sunday, the 8th, they were noticed depressed; would not eat, but some of them were reported as appearing much better, and it was thought they would recover. Later in the day they began showing meningeal symptoms, such as turning in a circle, pulling backwards, butting their heads against objects and appearing generally wild. A twitching of the muscles was also noticed and autopsies were made on these two animals and one other noted above by Drs. Brimhall, Reynolds and Beckman.

Six of the eight head which were originally taken sick died during Sunday night and early Monday morning. The other two were found sick on Monday morning and one of them would not get up at the time of observation by Dr. Reynolds. The one which would get up was not noticed at first as being excitable and appeared quite normal; temperature 100.1°. The other one could not be made to rise and she had distinct twisting of the neck due to contraction of the muscles. The eyes had a vacant appearance and she was apparently totally blind. Her temperature was not quite 100°. Both of these animals became worse and died that night. On June ninth autopsies were made on these two animals and one other noted above by Drs. Brimhall, Reynolds and Beckman.

These animals had been dead 15 to 18 hours and as the weather was quite hot, the post-mortem changes were rapid. They had been skinned, some of them for a considerable length of time, and the surface of the carcass having become dried, the superficial lesions were obscured. Some areas of hemorrhage had been noticed, but the fact that the cattle had been so violent in the stable before dying, made their significance somewhat doubtful since the lesions had not been observed in their fresh state.

Internal lesions. The lungs of all of them showed distinct congestion in the anterior lobes especially surrounding the heart and blood vessels. In nearly all of them there was a slight, reddish exudate bound to the costal pleura. There were no characteristic hemorrhagic areas of any considerable size observed in the internal organs. The meninges of the brain and cord showed marked congestion and surrounding the cord was considerable inflammatory exudate.

Cultures were taken in each case from the meninges, pharyngeal glands, lung, heart's blood, liver and spleen. The animals had been dead so long, and the weather being warm, bacterial invasion had been rapid.

From cow No. 6, *B. bovisepticus* was obtained from the meninges and lung, mixed with other organisms, namely, colon and other large bacilli. From cow No. 7, *B. bovisepticus* was obtained in pure culture from the pharyngeal gland and mixed with other organisms from the lung. From cow No. 8, no pathogenic bacteria were found, all the cultures containing *B. coli communis* and large, liquefying organisms.

On June 13, 1902, rabbit No. 569 was inoculated intravenously with a 24-hour broth and serum emulsion of *B. bovisepticus* obtained from the meninges of cow No. 6. This rabbit died June 16, 1902. At autopsy, a large, hemorrhagic area was found in the subcutaneous tissue of the chest. The peritoneal cavity contained a large amount of bloody exudate and small hemorrhages were found in the intestines. *B. bovisepticus* was obtained in pure culture from the heart's blood.

June 13, 1902, rabbit No. 570 was inoculated, intravenously, with a 48-hour broth and serum culture of *B. bovisepticus* obtained from the pharyngeal gland of cow No. 7. This rabbit showed no symptoms.

The ninth animal was taken sick on June 11th, and died the same night. She was not noticed excitable; her temperature was not observed above normal, but before death she evidently moved some distance from the place where she was last observed.

Th last animal was observed in a better condition at autopsy June 12th, and in removing both front legs characteristic hemorrhagic areas were found under the scapula. Small hemorrhagic areas were found on the pericardium, the parietal pleura and on the heart itself. The lungs had the same congested appearance as noticed in previous cases with a few small, characteristic hemorrhagic areas. The cord, especially in the region of the medulla, was surrounded by a distinct hemorrhage with a bloody exudate and the membranes of the cord were distended by a quantity of clear fluid. The brain and coverings were free from congestion. This animal had also been skinned. The carcass having become dried, the superficial lesions could not be observed.

Cultures were taken from the meninges, pharyngeal glands, glands of the shoulder, heart's blood, lung, liver, spleen and amniotic fluid. *B. bovisepticus* was obtained in pure culture from the liver and spleen. All the other cultures were overgrown with colon and liquefying organisms.

On June 17, 1902, rabbit No. 573 was inoculated intravenously, with a 24-hour broth and serum culture of *B. bovisepticus* obtained from the spleen. This rabbit has shown no symptoms. On the same date, rabbit No. 574 was inoculated with a 24-hour broth and serum culture of *B. bovisepticus* obtained from the liver of this cow. This rabbit died June 22d. At autopsy, minute hemorrhages were found over the auricles of the heart. No other gross lesions were observed.

It will thus be seen that although these animals presented characteristic symptoms of cerebo-spinal meningitis such as are caused by *diplococcus pneumoniæ*, this organism was not obtained in any of the four cases at autopsy, but instead the autopsy findings were those of hemorrhagic septicæmia, and bacillus bovisepticus was obtained from three of the four animals examined and shown to be virulent. The failure to obtain *B. bovisepticus* from one of the cows was probably owing to the very great mixture of other organisms which developed post-mortem. There can be no question but that the disease was hemorrhagic septicæmia affecting primarily the central nervous system; in other words, a primary cerebro-spinal meningitis due to *B. bovisepticus.*

Outbreak 76—*Perham, Otter Tail County.*—July 23, 1902, Dr. Edward C. Schoonmaker, health officer of Perham, reported to Dr. Brimhall that there had been 20 head of cattle lost in that village during the winter, and that Dr. Judd, veterinarian, after consulting Dr. Annand, had diagnosed the cause of the deaths to be due to chronic hæmorrhagic septicæmia. Dr. Brimhall had further correspondence with Dr. Judd and from the history and symptoms as described by him Dr. Brimhall confirmed the diagnosis.

Outbreak 77—*Sauk Center Township, Stearns Co.*—July 30, 1902, Dr. Annand investigated an outbreak of cattle disease on the farm of Mr. W. H. P. in Sauk Center Township, Stearns county. Three animals presented swellings on different parts of the body. One heifer had an enlargement in the submaxillary space which had erupted and at the time was nearly well. One steer had had an enlargement in the region of the right stifle. This had also opened and discharged. Another steer had an enlargement close to the posterior angle of the lower jaw on the right side of the head, and a row of enlargements or bunches upon the external surface of the right hind leg from the hock to the hoof. These latter were opened by Dr. Annand and a peculiar semi-fluid pus (?), having a consistency of melted glue, was found. A small amount of this material was collected in a sterilized bottle and sent to the laboratory.

The material above noted showed in direct coverslips a very few small diplococcoid belted bacilli. Cultures in broth and on serum gave *B. bovisepticus* in abundance in the mixture with a few large spore-bearing bacilli with rounded ends (contamination from hair?).

These cases are of peculiar interest in showing the chronic form of hemorrhagic septicæmia with pus formation which has been noted by other observers, but which, prior to this time, had not been observed in Minnesota except when associated with other symptoms, either in the same animal or in other animals in the same outbreak.

Outbreak 78—Burnhamville Township, Todd County.—Sept. 30, 1902, Dr. Annand visited the farm of Mr. C. Z., Burnhamville township, Todd county (14 miles east of Long Prairie), to investigate a report of supposed tuberculosis.

During the winter of 1901 and 1902 some of Mr. Z's. cattle had been ailing, that is, were coughing and did not put on flesh rapidly. All appeared, however, to make complete recovery during the spring. About three weeks ago, one cow was found dead in the pasture, four to six hours after she had been observed eating, apparently in perfect health. Another was found dead in the barn on the following morning though she had given the ordinary amount of milk on the previous evening. A third after ailing about two weeks was killed. A fourth which had been sick two or three weeks was destroyed for autopsy September 30th, at 4 p. m. by Dr. Annand. The animal which had been in good health up to two weeks ago and in good order was now markedly emaciated and coughed frequently. On post-mortem examination the only lesions present were as follows:

Marked gelatinous exudate in the intercostal muscles on both sides.

Posterior lobes of both lungs of typical "swine plague" variety. Small hemorrhagic areas were scattered throughout the other lobes also.

Minute petechiæ were present on the pericardium.

About two quarts of fluid was in the peritoneal cavity.

The spleen was of the dry variety noted in some previous outbreaks.

Immediately before death this animal's temperature was 103.6 and pulse rate 82.

On receipt in the laboratory direct coverslip preparations and cultures were made from each of the specimens. After 24 hours incubation the broth cultures showed the following:

Heart's blood. Diploccocci and small diplococcoid, non-motile banded Gram-minus bacilli (probably B. *bovisepticus*).

Heart's wall. *B. coli communis* (?), long slender bacilli, non-motile and diplococci.

Lung. Diplococci, *B. coli communis*, large spore-bearing bacilli and a very few resembling *B. hemorrhagic septicæmia.*

Spleen. *B. coli communis*, large spore-bearing bacilli, small oval spore-bearing bacilli and a few diplococci.

Original broth cultures were diluted into second broths and from these streak cultures were made on agar and serum. After 24 hours incubation 41 single colonies were picked from the agar and serum from various sources. After 24 hours incubation these were examined in stained and hanging drop preparations and certain of them sown on various differentiating media.

There was thus obtained:

Heart's blood. *B. bovisepticus* and *diplococcus pneumoniæ.*

Heart's wall. *Diplococcus pneumoniæ*, *B. coli communis* and a small unidentified bacillus.

Lung. *B. coli communis*, *diplococcus pneumoniæ* and an unidentified spore-bearing bacillus.

Spleen. *B. coli communis* and large and small spore-bearing bacilli.

Summary. The specimens had been much contaminated when received in the laboratory. Probably the only bacteria of pathological significance was *B. bovisepticus* and perhaps *diplococcus pneumoniæ.*

Outbreak 79.—*Jasper, Pipestone County.*—Oct. 28, 1902, Dr. Brimhall visited the farm of Mr. A. M., near Jasper, Pipestone county. Mr. M. had lost 11 head of cattle during the previous week. He thought the cause of death was due to sudden change of feed to soft corn and barley. His herd had originally consisted of 37 feeding steers and six calves. They had been taken out of rape pasture October 25th, and put on soft snap corn with ground barley in limited quantity. On the morning of the 26th, all of the animals were noticed to be "dumpish" and some appeared to be sick. On the 27th five were dead. The rest showed distinct symptoms of sickness, being stiff, lying down and breathing hard. All but one had severe diarrhoea. On the 28th, five cattle and one calf were found dead. The owner said that all of them bloated severely though this was not found to be true by Dr. Brimhall.

An autopsy was made on one dead about 48 hours. There were no well marked lesions, but the few present were of a distinctly hemorrhagic character. The animal which had been dead about 24 hours showed distinct hemorrhagic enteritis. The owner was told that the trouble was possibly hemorrhagic septicæmia and that the infection if any might have been obtained from the field where the snap corn was gathered. He was advised to feed no more of it.

Portions of lung and spleen from these two autopsies were brought to the laboratory Oct. 30, 1902. They were in an advanced state of decomposition and no bacteria resembling B. bovisepticus were obtained.

This outbreak is here mentioned to show the difficulty of diagnosis from history and symptoms and autopsy observations or bacteriological examination from decomposed material after decomposition has set in.

Outbreak 80—*Altona Township, Pipestone County.*—Nov. 23, 1902, Dr. Annand visited the farm of Mr. A. T., Altona Township, Pipestone county, near Verdi, Minn. Mr. T. had lost seven head of cattle in two weeks previous and two others were sick at the time of Dr. Annand's visit. One calf had died about six hours before Dr. Annand's arrival, after an illness of about 16 hours. A post-mortem examination was made at once. A large hemorrhage area was present on left side of the neck along the cervical muscles. Another large hemorrhagic area was present on the right side over the ribs. The third was present on the inner aspect of the left hind limb. Numerous smaller areas were present on the extremities above the hock joints. On the articular surface of the metatarsals and metacarpals small hemorrhagic areas were also present. The lung showed hemorrhagic lesions of the swine plague type. The small intestines were much congested. The animal had had a slight bloody discharge from the nose and the fæcal matter was streaked with blood previous to death. Mr. T's boys, who had skinned the other six head of cattle, stated that there were more or less bruises on the body similar to those found in this animal.

Cultures were made from heart, lung and liver in broth and on serum. After 24 hours in the incubator those from the heart and lung showed bacteria which on further culture proved to be B. bovisepticus. There was also present on all of the organs B. coli communis. (This latter may have been a contamination due to the method of collection and shipment of the specimen.)

Outbreak 81—*Perham Township, Otter Tail County.*—Dec. 23, 1902, Dr. F. E. Judd of Perham, Minn., reported to the veterinary department of this board that "on the 18th of December Mr. S. H. of Perham Township, Otter Tail county, lost a calf about six months old which had been sick only ten hours. When first noticed to be sick it had ceased eating and began to stagger about. In a short time it lay down and refused to get up. There was excessive diarrhoea but the animal did not seem to be in much pain. After it died and while removing the hide they noticed what they called 'blood clots' in the connective tissue along the side of the neck. They said these clots were about one inch in diameter and the tongue was covered with dark 'pustules' which contained blood.

"On December 21st they called Dr. Judd to the farm to see a three-year-old heifer which had refused its food and was moaning, and when moving about showed a staggering gait. The animal had a bad diarrhoea and when examined by Dr. Judd was lying down and refused to get up. After some excitement, however, she did get up, but seemed to be very weak, though in little pain. Her temperature was 102.5. The discharge from the bowels was black and 'muco-tarry' in appearance. There was no positive swelling on her. She died about an hour after. Autopsy showed hemorrhagic spots in the connective tissue just under the skin, varying in size from one-eighth to two inches in diameter. There were larger spots, also, along the cervical region. The peritoneal fluid was slightly yellowish. The peritoneum and pleura were more or less covered with hemorrhagic spots. The lungs, liver and spleen were also somewhat involved. The heart was slightly filled with clotted blood. A diagnosis of hemorrhagic septicæmia was made.

"December 22d another calf began developing the same symptoms and died in 24 hours."

Mr. H. had 10 head of cattle in this herd; all in good flesh; He had been feeding slough hay, corn, oats, straw and some bran. He had not added any cattle to his herd in the preceding six months. He was advised to isolate the well cattle from the sick and destroy all bedding and litter in the stable and to use plenty of antiseptics and disinfectants.

Outbreak 82—Lake Park Township, Becker County.—Dec. 27, 1902, Dr. A. Youngberg of Detroit, Minn., visited the farm of Mr. E. G. M., near Lake Park, Minn., and investigated an outbreak of cattle disease. Mr. M. had lost five head of cattle in two weeks immediately preceding Dr. Youngberg's visit. One had died shortly before. An autopsy was made and portions of lung, pleura, peritoneum and brain, packed together in an unsterilized fruit jar and sent to the laboratory. From the history and symptoms and postmortem lesions Dr. Youngberger diagnosed the disease as hæmorrhagic septicæmia.

The specimens when received in the laboratory were much decomposed. Coverslip preparations and cultures showed only B. coli communis and a large square ended (putrefactive?) bacillus.

Outbreak 83—West Concord, Dodge County.—Jan. 9, 1903, Dr. Annand visited the farm of Mr. H., six miles west of West Concord. Mr. H. had lost two head of cattle in October, 1902, and had been losing them at irregular intervals since. He lost in all seven head. All were young stock—calves to yearlings. A calf a few months old was killed and an autopsy made at once. Many large hæmorrhagic areas were found on the extremities and small ones in the lungs and intestines. A diagnosis of hæmorrhagic septicæmia was made.

Outbreak 84—St. Peter, Nicollet County.—Feb. 6, 1903, there was received in the laboratory, through Dr. Brimhall, specimens of organs from a steer which had been killed by Dr. Lambert of St. Peter, Minn., for purpose of autopsy, on Feb. 3, 1903.

The animal was one of a herd of 35, the property of Mr. O. Three others had died prior to February 3d, after exhibiting symptoms of rapid, labored breathing, temperature 103° to 104.5°; loss of appetite, mucous or bloody discharge from the bowels and great icthyosis of skin.

Specimens consisted of portions of lung, heart, spleen and liver. Though the weather was cold they were not frozen and had begun to decompose.

Cultures were made in broth and on serum from each of the four sources. After incubation bacteria as follows were found:

Lung. *B. bovisepticus,* diplococci.

Spleen. *B. bovisepticus,* large spore-bearing bacilli, probably putrefactive.

Liver. Large spore-bearing bacilli, probably putrefactive.

All organs. *B. coli communis.*

The only organism of pathological significance here found was *B.bovisepticus,* and a diagnosis of *hemorrhagic septicæmia* was given.

Feb. 12, 1903, there was received in the laboratory from Dr. J. G. Annand, organs from a steer which he had killed on the previous day for purpose of autopsy. The animal had been the property of Mr. O. near St. Peter, Minn., and one of the same herd as that from which the animal in the case reported by Dr. Lambert came.

Specimens were cold but not frozen when received in the laboratory.

Direct coverslip preparations and cultures were made from the spinal cord, lung, spleen and liver.

The *bacillus of hemorrhagic septicæmia* was found in preparations from lung, spleen and spinal cord.

B. coli communis and a large spore-bearing bacillus from lung, spleen and liver.

Mr. H. had 10 head of cattle in this herd; all in good flesh.

Outbreak 85—Elmore, Faribault County.—Feb. 18, 1903, Dr. Annand visited the farm of Mr. K. near Elmore, Minn., to investigate an outbreak of disease among a herd of 16 cattle. All the animals, eight, which had been sick had been dead some time at the time of Dr. Annand's visit and no post-mortem examination could be obtained. From the history and symptoms described, Dr. Annand felt positive that hæmorrhagic septicæmia was the cause of the loss.

Outbreak 86—Ripley Township, Dodge County.—Feb. 23, 1903, Dr. Annand visited the farm of Mr. S., then operated by Mr. M., in Ripley Township, Dodge county, near Dodge Center, and investigated an outbreak of disease among cattle and sheep. The herd of cattle consisted originally of 103 head, of which more than 50 had died since the middle of January. The first to die were two old cows. The owner had skinned two or three of the animals and found skin lesions, such as Dr. Annand afterward found in autopsy. (See below.) One steer had taken sick February 21st, and at the time of Dr. Annand's visit was down and almost dead. The animal was killed and an autopsy made at once. Numerous large hæmorrhagic lesions were present about the neck, shoulder, fetlock and hock; smaller ones were scattered over the body. The lesions on the internal organs were not large nor well marked. Portions of the lung, heart, spleen, liver and kidney were taken to the laboratory.

Direct coverslip preparations and cultures in broth and on serum were made from each organ.

Direct coverslip preparations from the spleen and liver stained with eosin and methylene blue showed each a few diplococcoid belted bacilli. Similar preparations from the lung, heart and kidney showed no organisms.

Cultures, after 24 hours in the incubator, showed no growth from heart's blood or kidney. From the liver and spleen a pure culture of *B. bovisepticus* was obtained. From the lung *B. bovisepticus* was isolated from a mixture of diplococci and a large liquefying mould-like organism, probably a contamination.

Mr. M. had also lost 16 head of sheep since the middle of January, and apparently from the same disease as that causing the death of cattle. Post-mortem examination was held on one ewe, and hemorrhagic lesions similar to those found in the steer were present, though not well marked. Portions of lung, heart, spleen, liver and kidney were brought to the laboratory. Direct coverslip preparations and cultures in broth and on serum were made from each of the organs. Direct coverslip preparations stained with eosin and methylene blue showed from the spleen a very few small diplococcoid belted bacilli. Those from the other organs showed no bacteria. After 24 hours in the incubator the cultures from the spleen and liver showed small diplococcoid bacilli which were proven on subsequent cultures to be *B. hæmorrhagica septicæmiae.* All other cultures remained sterile after seven days in the incubator.

Outbreak 87—Wyanett Township, Isanti County.—Feb. 25, 1903, Dr. Annand visited the farm of Mr. W., in Wyanett Township, Isanti county, to investigate a case of supposed tuberculosis. He found, however, that it was a case which from history and symptoms was undoubtedly hæmorrhagic septicæmia.

Outbreak 88—Walcott Township, Rice County.—March 11, 1903, Dr. Annand visited the farm of Mr. C., Walcott Township, Rice county, near Faribault, to investigate an outbreak of disease in a herd of cattle. Mr. C. had lost six out of a herd of 40 in two or three weeks just prior to Dr. Annand's visit. One which had recently died was examined post-mortem. Typical lesions of hæmorrhagic septicæmia were present. A change of yard and disinfection of the barn was advised.

Outbreak 89—Twin Lakes Township, Freeborn County.—March 12, 1903, Dr. Annand visited the farm of Mr. E. A. O., Twin Lakes Township, Freeborn county, near Albert Lea. Mr. O. reported the recent loss of eight head of cattle out of his herd of 60. A post-mortem examination was made on a calf which had died the previous night. Typical lesions of hemorrhagic septicæmia were found. A change of yard and disinfection of barns were advised.

Outbreak 90—*Wadena, Wadena County.*—March 26, 1903, Dr. Annand visited the farm of Mr. F., near Wadena, in Wadena county, to investigate the cause of some obscure disease in cattle. Mr. F. had had four sick cattle which he had destroyed when they were almost dead. This was several days before Dr. Annand's visit and no post-mortem could be obtained. There were no marked symptoms in any of the 40 head of cattle still remaining alive. From the history of the four animals which had been killed Dr. Annand was satisfied that they had been suffering from hemorrhagic septicæmia.

Outbreak 91—*White Earth, Becker County.*—March 30, 1903, Dr. A. Youngberg of Detroit, Minn., visited the White Earth Indian Reservation and examined and made an autopsy on two cattle (the property of the government). Several others had died just prior to Dr. Youngberg's visit. These two were quite sick and were killed for an autopsy. Hemorrhagic lesions were found subcutaneously and along the internal organs. Portions of heart wall and brain were placed in a small bottle and sent to the laboratory. These specimens were four days in transit and when received in the laboratory were covered with a thick, bloody fluid. No growth could be obtained from either the tissues or the fluid though large spore-bearing bacteria were present in direct coverslip preparations. On inquiry it was found that the bottle contained some whisky when the specimens were placed in it. While the results of the bacterial examination were thus negatived, the clinical and post-mortem observations were sufficiently clear to warrant a diagnosis of hemorrhagic septicæmia.

TABLE SHOWING OUTBREAKS OF HÆMORRHAGIC SEPTICÆMIA IN CATTLE IN MINNESOTA AUGUST, 1900, TO APRIL, 1903.

No. of Outbreak.	Investigation Began.	County.	Township.	No. of Cattle in Herd.	No. of Cattle Sick.	No. of Cattle Dead.
*1	August 18, 1900	Washington	Woodbury	26	15	15
*2	August 21, 1900	Anoka	Columbus	16	6	6
*3	Sept. 25, 1900	Todd	Eagle Valley	25	18	18
*4	October 31, 1900	Chisago	Branch	13	4	4
*5	Nov. 21, 1900	Redwood	Vesta	30	3	3
*6	Nov. 21, 1900	Redwood	Vesta	11	4	4
*7	Nov. 29, 1900	Wright	Cokato	13	8	8
*8	Dec. 18, 1900	Wabasha	Greenfield	26	6	6
9	January 8, 1901	Wright	Clearwater	18 ?	4	4
10	August 21, 1901	Anoka	Ham Lake	14	12	12
11	August 29, 1901	Isanti	Bradford	12	8	8
12	Sept. 19, 1901	Wabasha	Kellogg	20 ?	5	5
13	Oct. 4, 1901	Ramsey	State Experim't Sta.	35 ?	1	1
14	Nov. 1, 1901	Le Sueur	Kilkenny	15 ?	1	1
15	Nov. 20, 1901	Todd	Kandota	18	5	5
16-65	Nov. 26, 1901	Nobles Jackson	Worthington	1,000 ?	200 ?	200?
66	Feb. 11, 1902	Isanti	Dalbo	275	42	42
67	Feb. 12, 1902	Mille Lacs	Milaca	125	65	65
68	March 26, 1902	Todd	Gordon,	16 ?	9	5
69	March 26, 1902	Douglas	Osakis	1	1	1
70	April 24, 1902	Stearns	Brooten	12	6	6
71	April 25, 1902	Morrison	Little Falls	40 ?	4	4
72	May 2, 1902	Aitkin	Kimberley	425	60	60
73	May 21, 1902	Wadena	Huntersville	25	15	9
74	May 22, 1902	Wadena	Huntersville	40 ?	17	13
75	June 7, 1902	Ramsey	State Experim't Sta.	35 ?	9	9
76	July 23, 1902	Otter Tail	Perham	35 ?	20	20
77	July 30, 1902	Stearns	Sauk Center.	25 ?	3	0
78	Sept. 30, 1902	Todd	Burnhamville	40 ?	20	6
79	Oct. 28, 1902	Pipestone	Jasper	43	11	11
80	Nov. 23, 1902	Pipestone	Altona	40 ?	9	8
81	Dec. 23, 1902	Otter Tail	Perham	10	3	3
82	Dec. 27, 1902	Becker	Lake Park	10 ?	5	5
83	January 9, 1903	Dodge	West Concord	22	7	7
84	Feb. 6, 1903	Nicollet	St. Peter	33	5	5
85	Feb. 18, 1903	Faribault	Elmore	16	8	8
86	Feb. 23, 1903	Dodge	Ripley	103	52	52
87	Feb. 25, 1903	Isanti	Wyanett	4	1	1
88	March 11, 1903	Rice	Walcott	40	6	6
89	March 12, 1903	Freeborn	Twin Lakes	60	8	8
90	March 26, 1903	Wadena	Wadena	44	4	4
91	March 30, 1903	Becker	White Earth	40 ?	6	6
	Total			2,851	696	664

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* These 8 outbreaks were reported in the bulletin issued by this Board, January, 1901, and appear in the eighteenth report of this Board, pages 322-433.

? These figures are as nearly correct as possible, but exact information was not obtainable.

Summary. 1. It will be seen from the preceding detailed statement and the above map and table that from August, 1900, until April, 1903, this board has investigated in the state 91 outbreaks of hæmorrhagic septicæmia in cattle. These have been distributed in 26 counties. The total number of animals in the infected herds was about 2,850. Of these 696 became sick, of which 32 recovered and 664 died, making the mortality slightly over 95 per cent.

In addition to these outbreaks, the board has assisted the authorities of South Dakota in the investigation of supposed anthrax in cattle, some of which proved to be hemorrhagic septicæmia and some anthrax.

2. In addition to the symptoms described in the previous bulletin of the board, namely, loss of appetite, fever, stiffness, swelling of the legs and throat and a black, tarry or bloody discharge from the bowels, the symptoms of meningeal involvement as exhibited in Outbreaks Nos. 66, 67, 68, 70 and 75 are of particular interest. This type of the disease has been frequently described by other observers, but had not been met with in Minnesota up to the time of the issuing of the board's first bulletin on the subject. The local manifestation of the disease as exhibited in Outbreak No. 77, although previously described by other observers, has been met with but once in Minnesota.

3. The chief lesions discovered at autopsy have been ecchymoses, small and large hemorrhagic areas in the subcutaneous tissue, muscles, lymph glands and throughout the internal organs. The cervical lymph glands, heart muscle and alimentary canal were most affected. The spleen was rarely enlarged or darkened (except after the onset of decomposition). In those cases which exhibited meningeal symptoms there was a distinct meningitis with, in some cases, a plastic exudate almost filling the spinal canal and involving also the base of the brain.

4. Material from 27 outbreaks was investigated bacteriologically. Specimens were received in all from 47 animals. In 42 of these bacillus bovisepticus was insolated in pure culture. The specimens from the remaining 5 cases in which *B. bovisepticus* was not found were all in a very advanced state of decomposition when received in the laboratory. It is worthy of note that in all cases in which the cultures were sown immediately after death *B. bovisepticus* was obtained unmixed with any other organisms. Where decomposition was more or less advanced there were usually present putrefactive organisms.

The virulence of *B. bovisepticus* isolated from nearly all of the cases was tested on rabbits and from several on cattle. While there was considerable variation, most of the strains when recently isolated exhibited a high degree of virulence. It is not surprising that an organism which is so widely distributed and that affects such a great variety of animals as does the bacillus of hemorrhagic septicæmia, should exhibit a great variation in virulence nor that it should be found, as it has been by Smith and Moore,* finding lodgment in the upper air passages of animals and causing no symptoms. It will not do, however, to assume that since some members of the hemorrhagic septicæmia group of bacteria are occasionally found producing no symptoms though present in the air passages of cattle, that they are incapable of producing pneumonia when the normal resisting power of the animal is by any means lowered. This has been shown by Smith† in an investigation of sporadic broncho-pneumonia in cattle. When once virulent strains of members of this group of bacteria have penetrated into the circulation of susceptible animals, they cause either a true septicæmia or a meningitis or local abscesses according to their greater or lesser degree of virulence, the number gaining access to the circulation and the degree of resisting power of the animal. Indeed this organism appears to be capable of producing in several species of animals as great a diversity of symptoms and lesions as does the tubercle bacillus. When we remember that it is also capable of affecting almost all of the known domestic and many of the wild animals with a fatal form of disease, we appreciate the importance of early accurate diagnosis in all diseases in which the symptoms simulate those which may be caused by this bacillus.

5. The clinical diagnosis of hemorrhagic septicæmia in cattle from anthrax, black-leg and diplococcic cerebro-spinal meningitis, is exceedingly difficult. In fact, there is no typical history or chain of symptoms which may be relied upon. Fortunately, however, the post-mortem lesions are usually sufficiently definite to permit of a diagnosis by any veterinarian familiar with the disease.

Prior to the beginning of these investigations many deaths among cattle in Minnesota, as in other western states, were attributed to the so-called corn stalk disease. Though it is probable that other diseases have been included under this term, it is worthy of note that since the study of hemorrhagic septicæmia was begun in Minnesota, all cases which were reported as corn stalk disease and which were investigated by this board, have proven to be hemorrhagic septicæmia.

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*Bureau of Animal Industry. Special Report on Cause and Prevention of Swine Plague, Washington, 1891, page 151.

†Bureau of Animal Industry. 12th and 13th Annual Reports, Washington, 1897, page 119.

In all outbreaks clinical and autopsy data should be supplemented by a careful bacteriological examination.

6. Attempts at treatment of cattle suffering from hemorrhagic septicæmia have proven futile. The production of an immunizing serum is a possibility as was shown in the experiments detailed in the former bulletin by this board. It was hoped that, when a place for the keeping of large animals for experimentation near the laboratory had once been obtained, the experiments in immunization could be carried forward. The research laboratory of the board was occupied first in December, 1902. Since then it has been necessary for the laboratory to devote most of its time to the investigation of swamp fever and cerebro-spinal meningitis in horses. It is to be regretted much that the removal of veterinary matters from the jurisdiction of this board renders it impossible for the laboratory to continue the experiments, which promised so well, toward the production of an immunizing serum for hemorrhagic septicæmia.

7. The prompt removal of the dead animals and isolation of sick ones, accompanied by thorough disinfection by fire, carbolic acid, corrosive sublimate and freshly slacked lime has apparently served to check each outbreak within a short time where the measures have been carefully and persistently carried out. The greatest difficulty has been in segregating the animals which, though infected, showed no symptoms until from six to 24 hours before death. The splitting up of the herd into small groups in separate pastures has been the most successful method of segregation.

In only one outbreak, No. 67, has any difficulty been experienced in stopping the progress of the disease. In this it seems probable that infected animals were placed with the supposedly uninfected ones. It is interesting to note that in this outbreak, as also in Outbreak No. 1 (see bulletin), the use of blackleg vaccine had no immunizing effect.

ANTHRAX.

In portions of America this disease claims victims numbering into the thousands each year. The southern states are the greatest sufferers because of the facility with which the disease is spread, owing to climatic and other conditions, but many of our northern states are heavy losers. Minnesota has been especially fortunate in keeping free from anthrax during the past three years.

A number of outbreaks occurred in South Dakota during the summer of 1901, and the advisability of adopting quarantine measures against that state were seriously considered. Before taking such action it was decided than an investigation should be made in order that we might be familiar with the existing conditions and assure ourselves that the prevailing disease was true anthrax. The possibility of another disease being present (hæmorrhagic septicæmia), which was being mistaken for anthrax, was not lost sight of. The C., M. & St. P. Ry. Co. kindly furnished transportation, and on Aug. 16, 1901, Dr. Brimhall, in company with Dr. J. P. Foster, state veterinarian of South Dakota, began a tour of investigation in the infected regions. The disease had been prevalent in some sections of the state for a number of years and little or nothing had been done to check its spread until Dr. Foster took charge of the work. Through his efforts many hundred head of cattle were vaccinated and other precautionary measures instituted. One farm was visited where thirty-six head of cattle had died some four weeks previous. On the range near the stable there was one cow in a very weak and emaciated condition, which the owner stated was taken sick at the time and in the same manner as the ones which had died. With the owner's permission she was killed and an autopsy made at once. Chronic lesions were found, showing that hæmorrhages into the lymph glands and other organs had occurred early in the disease. Cultures and fresh specimens were obtained which were taken to the Minnesota State Board of Health Laboratory. Later reports from the laboratory confirmed the suspicion that the disease was hæmorrhagic septicæmia, Dr. Wilson having obtained pure cultures of *B. Bovisepticus* from part of the material.

While driving across the prairie on the return trip the veterinarians noted above observed in the distance what appeared to be the carcass of some large animal. On closer inspection it proved to be the dried hide and bones of a steer. Lime had been freely scattered over the hide. This was an indication that the owner believed the animal had died from anthrax. A small portion of the dried skin from this carcass was taken to the Minnesota State Board of Health laboratory. This portion of skin, one and a half inches long and about one-fourth inch wide was shaved from the region of the shoulder, where it had cracked open. From this bit of skin virulent cultures of anthrax bacilli were grown.

Anthrax has been found present in Minnesota during the last seven years of the board's work in but one locality (see Biennial Report, 1899-1900, page 454), although a number of examinations have been made for it. Many examinations for actinomycosis, anthrax and blackleg in man have proven to be streptococcus infection.

Laboratory Observations. *Case 1, Anthrax (Cattle)*—June 13, 1901, there was received in the laboratory a small quantity of greenish-yellow fluid in a bottle from Dr. L. A. Faulkner of Good Thunder, Minn. This specimen was collected from a case of some obscure disease in cattle, resembling anthrax. Direct coverslip preparations and cultures on serum and agar showed numerous bacilli and cocci, but none even remotely resembling bacillus anthracis.

Case 2—A report and examination of specimens of supposed anthrax from Blunt, S. D., is given under hæmorrhagic septicæmia, page 90.

Case 3—April 9, 1902, there was received in the laboratory a portion of spleen, accompanied by the following letter, from Rochester:

> Dear Doctor: I send by mail a section of spleen taken from a yearling steer supposed to have died from blackleg. The carcass was 12 hours' old when I held the post, and was inclined to believe it to be a case of anthrax, though I could not give a decided opinion. Dr. Granger mounted a specimen for me and called it anthrax. I would like to have it verified so send you a piece of same spleen. Kindly let me hear from you at once so I can inoculate the herd with the proper vaccine. Yours truly.
>
> EDWARD L. KALB.

Direct coverslip preparations and anærobic and ærobic cultures showed the presence of a putrefactive bacillus, *B. coli communis*, and many streptococci. Neither the bacilli of anthrax nor of symptomatic anthrax were present.

Case 4—This specimen in man is herewith reported because of its supposed origin from cattle.

Jan. 23, 1903, there was received in the laboratory from Dr. J. H. Beatty, St. Cloud, Minn., a serum culture of swab taken from the hand of one of the officers at the St. Cloud State Reformatory, accompanied by the following letter from Dr. Beatty:

> Enclosed in this smear box is a culture taken from an undoubted contagious skin disease that is endemic in the State Reformatory. This culture was taken from a sore on the hand of one of the officers. These sores resemble ringworm at first and then develop not unlike anthrax and are confined almost exclusively to barn men. If possible I would like a diagnosis.
>
> J. H. BEATTY.

The cultures from the swab and serum tube were sown into broth and on agar and fresh serum. After twenty-four hours in the incubator only staphylococci and streptococci developed. Subsequent cultures showed these to be staphylococcus pyogenes albus and streptococcus pyogenes. No other organisms were found in any of the cultures or in any coverslip preparations made from the original swab. Sections of tissue and fresh material were asked for, but could not be obtained, therefore histological study could not be made.

In connection with the presence of streptococci in these specimens reference should be made to the evident infection with streptococci of swine in the herd at the same institution. See page 88.

Feb. 3, 1903, there was received from Dr. Beatty another specimen consisting of a swab inoculated from the hand of a patient at the State Reformatory at St. Cloud, and several coverslip preparations. The coverslip preparations were stained with eosin and methylene blue, but showed no bacteria. Cultures made in broth and on agar and on serum showed a yellow white staphylococcus only.

Case 5—This specimen in man is herewith reported because of its supposed infection from cattle.

Feb. 14, 1903, there was received in the laboratory, through the Secretary of the State Board of Health, a specimen from a case of supposed anthrax, occurring in the practice of Dr. De Coster of Worthington, Minn. The patient, a young man, Mr. J. W., was a butcher. He had a crop of what appeared to be small boils about the left wrist. There were a few points of suppuration on the right wrist also. There were no symptoms of serious illness. Patient had had at no time a high temperature. The specimen consisted of an inoculated diphtheria swab and serum tube collected by Dr. Bracken.

The specimen was examined in direct coverslip preparations and in cultures in broth and on agar and on serum. Only streptococcus pyogenes and staphylococcus aureus and albus were present.

SYMPTOMATIC ANTHRAX.

This disease is causing the stock owners of this state but little trouble. The outbreaks have been few and were readily controlled by the use of vaccine. Reports that blackleg has existed in the following counties have been received: Meeker, Swift, Stearns, Polk, Sibley, Watonwan, Grant and Sherburn.

In a few instances blackleg has been encountered while investigating a disease the nature of which was unknown. The following extracts from the office records give a short account of some of these cases:

Oct. 25, 1900, went to McIntosh, Polk County, to make inquiry concerning cattle that had been reported to us as having died from some unknown cause. The information as to symptoms was unsatisfactory, but blackleg had been present in that neighborhood for the past two or three years, and it would seem quite probable that this disease had caused the death of the cattle under investigation.

Nov. 3, 1900, went to Madelia, drove out to Dr. C.'s farm and made an autopsy on a steer which had been dead about eighteen hours. While the symptoms were not characteristic, the evidence seemed sufficient to pronounce the disease blackleg. Specimens taken to the laboratory contained the bacillus of symptomatic anthrax, and this confirmed the clinical diagnosis.

Oct. 22, 1901, Drs. Brimhall and Wilson visited four farms two miles south and two miles east of Green Isle, Minn., and made autopsies on the bodies of two calves, one of which had been dead forty-eight hours, and the other was killed when almost dead for purposes of autopsy.

The following history of the outbreak was obtained:

Thursday, Oct. 17, 1901, there was found dead in a herd of cattle belonging to four or five farmers, four head of young cattle (calves, yearlings and two-year-olds). Between that time and the following Tuesday nine more died. None were over two years old and most of them were spring calves. All died within a few hours after the first symptoms were observed or were dead when found in the pasture. None exhibited any swelling. All of the animals except those noted above had been burned without skinning or opening.

One spring calf, which had died forty-eight hours before, the property of Mr. J. D. B., was in a rather advanced state of decomposition when examined. On the right flank and leg was a large blackened area which extended deep into the muscular tissue, which was quite black. A few small, apparently ante-mortem hæmorrhagic areas were found on the ventricles of the heart. The other lesions, if any existed, were too much obscured by the post-mortem changes to permit of any certainty in statements regarding them. It may be added that all of the tissues were markedly infiltrated with gas.

In the adjoining pasture, Mr. M. had three calves sick, one of which was almost dead. It was killed and immediately examined. On removing the skin no lesions were found. Internally, the peritoneum and a large portion of the stomach and bowels was found to be covered with a bloody exudate which was rather dark red and of a somewhat dry, plastic nature. The color was markedly different from that observed previously in cases of hæmorrhagic septicæmia. One or two small hææmorrhages were found on the right auricle of the heart. The muscles about the left hip joint were blackened. No gas was apparent in these muscles.

Owing to the history of the disease and the age of the animals affected, the localized lesion of blackened muscle in the first calf and similar condition in the second, a provisional diagnosis of symptomatic anthrax was given at the time and vaccination advised.

Direct coverslip preparations and cultures from the gluteal muscle, diaphragm, heart's blood, spleen and surface of peritoneum were taken. Direct coverslip preparations stained with eosin and methlyene blue showed from calf No. 1, a large spore-bearing bacillus, in which the spore was somewhat oval and located near but not directly at one end. From calf No. 2 was a more slender bacillus about the same length as that found in calf No. 1, but containing no spores. Cultures were grown both ærobically and anærobically. Aerobic cultures from calf No. 1 developed *B. coli communis (?)* from all sources. Those from calf No. 2 no bacteria except one colony of white staphylococcus on one of the two serum cultures from the gluteal muscle, probably a contamination.

Anærobic cultures from both calves 1 and 2 developed bacilli of symptomatic anthrax and from calf No. 1 a large putrefactive bacillus and *B. coli communis.*

Dr. Brimhall visited the farm of Mr. L. L. B. on Nov. 5, 1902, to investigate cause of death among cattle. They had lost five head of yearlings and two-year-olds. His herd consisted of about sixty cattle of all ages. The men who had skinned the animals stated that a number of bruised spots were noticed under the skin on some of the animals, but the owner had not noticed any swelling except upon the last one taken sick. This animal was still unburied, although it had been dead three days.

An autopsy was made and typical lesions of blackleg were found. The other animals were unburied and the heavy muscles of the legs were cut into, but no signs of blackleg tumors were found. From the description given by the parties who had removed the skin it seemed possible that some of these animals might have died of hæmorrhagic septicæmia, but the owner was advised that blackleg existed without question and it would be to his interest to vaccinate the rest of the young animals.

Nov. 6, 1902, there was received in the laboratory through Dr. Brimhall a portion of muscle from the calf noted above. Direct coverslip preparations and anærobic cultures showed the presence of the bacillus of symptomatic anthrax.

Nov. 6, 1902, guinea pig No. 557, weight 350 grammes, was inoculated subcutaneously in the right groin with one c.c. of the broth emulsion from the above case. The animal was found dead on the morning of Nov. 7. The muscles and subcutaneous tissues about the site of inoculation and extending over the abdomen were black and filled with gas. The bacilli of symptomatic anthrax were present in the blood smears and in anærobic cultures.

Subsequently Mr. B. stated that he had lost a three-months'-old calf suddenly after Dr. Brimhall's visit. He then vaccinated his herd with blackleg vaccine and lost no other animals.

The importance of the laboratory diagnosis in doubtful cases of blackleg is readily perceived when the resemblance between this disease and some forms of hæmorrhagic septicæmia is remembered.

ACTINOMYCOSIS.

From inquiry made of veterinarians throughout the state concerning the prevalence of the disease it would seem that it was on the increase, in some localities at least. Many of these cases are successfully operated on when taken in the early stages of the disease, but if it is a fact that this disease is on the increase it is important that steps be taken to determine the method by which it is spread. It is to be hoped that this work will be undertaken by some investigator in the near future. The experiment stations of this country have the best opportunities for solving this important question.

The total number of such infected animals killed at New Brighton, during this period, under inspection, is 209. These cattle were from points representing all sections of the state.

Laboratory Observations. The following examinations have been made in the laboratory for suspected actinomycosis:

Although this disease is fairly widespread through this state, it will be noted that few specimens come to the laboratory for examination, since in most cases a clinical diagnosis can readily be made.

Case 1 (Man)—This case is reported here because the infection was supposed to have come from the cattle.

Jan. 22, 1902, there was received in the laboratory a small vial containing bloody fluid. Accompanying this was the following letter:

North Branch, Jan. 21, 1902.

Dear Sir: I send you under separate cover a sample of pus taken today from a suppurating gland just below the left jaw. I have reason to believe it is of actinomycotic origin. The patient came to me first in June last with an abscess of the gland under the right jaw. At the same time she had a suppurating submaxillary gland. Since that date I have repeatedly opened the suppurating gland in the neck and in the throat. The granular form of the pus has led me to suspect the character and lead me to think the disease a true actinomycosis. A true report of the condition of the pus will greatly oblige,

OSCAR O. FLIESBURG.

Careful microscopic study of stained preparations failed to show anything which resembled actinomyces. Numerous preparations were stained with carbol fuchsin, destained with acid and counterstained with methylene blue for tubercle bacilli, but with negative results.

Case 2 (Man)—This specimen in man is here reported because of its supposed infection from cattle.

Feb. 8, 1902, there was received in the laboratory a specimen of pus, accompanied by the following letter:

Gary, Minn., Feb. 8, 1902.

Dr. F. F. Wesbrook, Minneapolis,

Dear Doctor: I send you a specimen of pus taken from swelling in the submaxillary region of a man, 62 years of age. One month ago he first noticed a swelling in said region, not much pain, but has steadily increased in size, and lately taken a reddish hue. I drew off about a pint of thin stained pus. It looks to me very much like actinomycosis. The patient has a tuberculous history.

FREDERICK O. GRONVOLD.

Microscopic examination of the specimen showed an abundance of bacteria of divers kinds, including many bacilli of various sizes, diplococci and a few streptococci. Tubercle bacilli were not demonstrated, although of course this did not eliminate the possibility of their presence in the pus. No actinomyces could be found.

Case 3 (Man)—This supposed case of actinomycosis, although occurring in man is herewith reported because of a supposed infection from cattle.

Dec. 5, 1902, there was received in the laboratory a small piece of tissue, accompanied by the following letter:

Mankato, Minn., Dec. 4, 1902.

Dr. F. F. Wesbrook, Laboratory State Board of Health, Minneapolis.

Dear Doctor: We send you by this afternoon's mail, a piece of tissue removed from the middle phalynx of the middle finger of a patient who was in our office this morning.

The patient is a man 66 years of age. Has always been in good health. Between Sept. 15th and 20th, 1901, a sore began to form on the right wrist on its dorsal and external surface. It began with an appearance, he says, of a ringworm. This was cut out. Soon after this the trouble began on the dorsal surface of the middle phalynx of the middle finger. There is also trouble, similar on skin over the proximal end of phalanx of the same finger. Five weeks ago he bruised his wrist and following that the condition similar to the first began there at the edge of the scar. These eruptions are granular in appearance and painless. There is some induration at their bases. They are somewhat granular. There is some discharge of pus containing small yellow particles. There are white nodular appearing masses over the surface which he says first made their appearance after using an ointment which he was given. The two sores on the wrist are each about two by three inches in diameter. There is no glandular enlargement.

> He gives a history of having cared for a cow which had a swollen and sore udder. He milked the cow and dressed the wounds which, after the purulent discharge, had been left. This udder suppurated in several places and a large slough separated from it. The cow apparently recovered after a time. The sores on his hand began soon after he had cared for this cow. He knew that on his finger there was an abrasion of the skin. We thought you would be interested in this case, and we would like to know the bacteriology and pathology of this case if possible.
>
> Very respectfully,
>
> DRS. ANDREWS, HOLBROOK & OSBORN.

The specimen consisted of a small piece of tissue showing one skin surface. After the removal of material for cultures (which remained sterile after several days in the incubator) the tissue was fixed in alcohol and formaldehyde and imbedded in parrafin, cut and stained by various methods. There was no evidence of actinomycosis, blastomycosis, tuberculosis, epithelioma or carcinoma in the tissue. It resembled in structure and arrangement a warty or papillomatous growth. There was some infiltration with leucocytes and other evidence of proximity to inflammatory foci.

A voluminous correspondence failed to elicit any new facts concerning the history of the case, and since the patient had left Mankato it was impossible to obtain any other specimens of tissue.

Case 4 (Man)—This specimen is here reported because of its supposed infection from cattle.

March 6, 1903, there was received in the laboratory a specimen of a tumor, accompanied by the following letter:

> Dear Doctor: I take the liberty of sending you by express one-half of a tumor removed from the scalp of a boy. I suspect it to be actinomycosis but I have not been able to find the mycelium. There is some doubt between this diagnosis and possible tuberculosis. The boy hurt his head last fall. The wound healed up but three or four weeks later started to grow, and when he came to see me the tumor was as large as a small orange. Pus ran out all around it and it was quite painful to touch. One axillary gland (right) was enlarged. He has also enlarged lympathic glands under the maxilla although very small.
>
> I first thought it was a sarcoma, but gave up this diagnosis in behalf of actionomycosis. There was a small spot on the neck (the size of a penny) and suppurating; another small spot in the right cheek. The specimen is in alcohol.
>
> Yours truly,
>
> J. LYNN.

Since the specimen was in alcohol when received in the laboratory only a histological examination could be made. Sections were cut from four different areas and stained by various methods. The histological diagnosis lay between round celled-sarcoma, and an infectious process. No bacteria of any kind were found, nor any actinomyces. It may be possible that the alcohol was not sufficiently strong to fix any parasites had they been present. Thus actinomycosis could not be excluded as a possible diagnosis. No tubercles were present in the tissue.

Case 5 (Cattle)—Oct. 10, 1902, Dr. Beckman visited the State Experiment Station and collected cultures of pieces of tissue from a tumor of the lower jaw of a young heifer. The culture showed an organism resembling actinomycosis on broth, but this did not grow upon any solid media. The pieces of tissue showed actinomyces in great abundance.

Case 6 (Cattle)—Feb. 2, 1903, there was received in the laboratory a small tin box containing some thick tenacious pus. On the same date was received the following letter concerning it:

> Dear Sir: My cows have bunches about two by three inches in diameter under the jaws; some have one and others have two. The bunches are very solid. One some of them we put "lump jaw cure" and they disappeared, loosening the skin so that it hangs loose, and drops off. One lump we cut open with a knife. It contained pus, which I herewith send to you in a small tin box. Please examine it and then let me know what the disease is. Box has been boiled according to Dr. Brimhall's direction, so it was thoroughly clean before using. The lumps or balls will slip up and down under the skin. It is a very hard task to cut them. The doctors here call it "skin lump jaw." Yours very truly,
>
> W. H. R., Gary, Minn.

The specimen was examined in direct coverslip preparations and in cultures. There were no actinomyces present. Two different kinds of bacilli were obtained in the cultures. One produced a white, abundant growth on solid media somewhat resembling *B. coli communis.* Serum was not liquefied by this organism, but milk was rendered acid, coagulated and later digested. The other micro-organism was a bacillus which produced a yellow pigment, but did not liquefy serum and alkalinized milk without coagulating it.

MALIGNANT CATARRH IN CATTLE.

Several outbreaks of this fatal disease have come under the notice of this board. One of these was reported in the Biennial Report for 1899-1900, pages 274 and 453, as occurring in New Market Township, Scott County, near Farmington, Minn. From five of the animals suffering with the disease on this farm, a very short, unevenly-staining, belted diplococcoid bacillus, highly pathogenic for guinea pigs and rabbits, was isolated from the cranial sinuses.

During the biennial period just closed, three outbreaks have been studied, as follows:

Farmington, Minn.—June 21, 1901, Drs. Brimhall and Wilson visited the farm of Mr. John Forstrom, in Eureka Township, Dakota County, seven miles southwest of Farmington, Minn., to investigate an outbreak of malignant catarrh in cattle. This herd consisted of thirteen head of cattle of varying ages. About a year previously one had died, and within two or three weeks three others had sickened and died. One yearling heifer had been sick five days at the time of the visit. Her temperature was 106.4°. There was a watery discharge from the left eye, which seemed much inflamed. There was a muco-purulent discharge from the nose. The animal was very thin and showed great depression. It was killed and an autopsy made at once. The gross pathological findings were entirely negative except a marked inflammation of all the serous membranes and of the mucuous membranes of the nose and alimentary canal.

Cultures and direct coverslip preparations were made from the frontal sinus, inside of horn (one of which had fallen off and the other of which was readily removed), the anterior eye chamber, heart's blood, pericardium, hip joint and enlarged inguinal gland.

The direct coverslip preparations were stained with eosin and methylene blue and carefully examined. A few isolated pairs of minute diplococci or diplococcoid bacilli were found in one or more of the coverslips from the material from the horn, the eye and the hip joint. None were found in any of the preparations from any of the other sources and no other bacteria of any kind were observed in any of the preparations.

Cultures examined after thirty-six hours in the incubator. Horn—One of the two broth cultures showed a few minute diplococci, streptococci or diplococcoid bacilli in very short chains.

The serum cultures showed none. One of the two serum cultures from the frontal sinus showed a few diplo-bacilli (similar to those from the horn) in the water of condensation. None in the other serum cultures nor in the two broth cultures. One broth and both serum cultures from the anterior eye chamber showed diplo-bacilli, the same as those from the horn. The other broth culture contained a heavy film made up of long slender bacilli, probably a contamination from the air. One broth and one serum culture from the pericardial fluid showed a few diplo-bacilli and streptococci, the same as from the horn. The other broth and the other serum culture showed no bacteria. From the hip joint, one broth and one serum culture showed the diplo-bacilli. The other broth and the other serum culture showed no bacteria. No bacteria were found in any of the four cultures from the enlarged inguinal gland nor in any of the nine abundantly sown broth cultures from the heart's blood.

It will be noted that no bacteria except the diplo-bacilli and one contamination (see above) were found in any of the cultures and that this was present very sparingly in one or more of the several cultures from the horn, frontal sinus, anterior eye chamber, pericardial fluid and hip joint, while absent entirely in the cultures from the inguinal gland and the heart's blood. Second cultures from the original ones from the horn and hip joint were sown abundantly on serum and in plain broth, grown twenty-four hours in the incubator and used for the inoculation of rabbits Nos. 438-39-40-41 and guinea pigs Nos. 437-38-39-40.

Rabbit No. 438, weight 1,725 grammes, was inoculated June 26, 1901, in the left subdural space with 0.2 c.c. of an emulsion of a twenty-four-hour broth and a twenty-four-hour serum culture second from original diplo-bacilli (?), isolated from the horn of heifer noted above. Animal was found dead July 9, 1901. An autopsy showed some purulent discharge from the right nostril; considerable inflammation of the meninges of the brain; brain not apparently softened; trachea contained considerable mucus; bladder was distended. No other gross lesions were observed.

Cultures in broth and on serum were made from the meninges of the brain and from the heart's blood. Direct coverslip preparations from the meninges showed no bacteria nor were there any found in those from the heart's blood. Cultures in broth and on Löffler's blood serum from the meninges showed a few diplo-bacilli. Those from the heart's blood gave no growth.

Rabbit No. 439, weight 1,400 grammes, was inoculated June 26, 1901, in the left subdural space with 0.2 c.c. of an emulsion of a twenty-four-hour broth and a twenty-four-hour serum culture second from original diplo-bacillus isolated from hip joint of heifer noted above. The animal was alive and well six months later, having shown no symptoms in the meantime.

Rabbit No. 440, weight 1,235 grammes, was inoculated June 26, 1901, intraperitoneally with 1.5 c.c. of an emulsion of a twenty-four-hour broth and a twenty-four-hour serum culture second from original diplo-bacillus isolated from horn of heifer in case noted. Also 0.5 c.c. of same material as noted above was injected high into the right nostril. July 14, 1901, the animal was apparently sick and not eating properly. July 15, the animal had intense diarrhœa, and July 16 it was found dead at 9 a. m. At autopsy, no gross lesions were found except some inflammation of the mucosa of the intestine. No bacteria were found in direct coverslips or cultures from lung, heart's blood, spleen, liver or peritoneal fluid.

Rabbit No. 441, weight 1,670 grammes, was inoculated intraperitoneally June 26, 1901, with 1.5 c.c. of an emulsion of twenty-four-hour broth and a twenty-four-hour serum culture second from original diplo-bacillus isolated from the hip joint of heifer noted above. Also 0.5 c.c. of the same material as above was injected high into the right nostril. After five months the animal was still alive, having shown no symptoms in the meantime.

Guinea pig No. 437, weight 625 grammes, was inoculated on June 26, 1901, in the left subdural space with 0.2 c.c. of a twenty-four-hour broth and a twenty-four-hour serum culture second from original diplo-bacillus isolated from the horn of heifer in case noted above. The animal was found dead July 7, 1901. Brain and meninges were congested. Skin wound was open. No special areas of inflammation at the site of inoculation. There was an increased amount of peritoneal fluid which was blood tinged. The parietal peritoneum was congested; the bowel contents were fluid and a considerable portion of the mucosa of the small intestine was congested. The liver, spleen and kidneys were microscopically normal. Cultures from the peritoneal fluid after twenty-four hours in the incubator showed an abundant growth of a minute diplo-bacillus similar in appearance and staining reaction to the organism originally inoculated subdurally. From the meninges and heart's blood a few colonies of the same organism was obtained.

Guinea pig No. 438, weight 740 grammes, was inoculated June 26, 1901, in the left subdural space with 0.2 c.c. of an emulsion of a twenty-four-hour broth and a twenty-four-hour serum culture second from original diplo-bacillus isolated from hip joint of heifer noted above. The animal jumped during the operation and the brain was probably somewhat injured. Dead June 30, 1901. At autopsy extensive extravasation of blood was present in the subcutaneous tissue over the skull. The brain was very soft with considerable hemorrhage at site of inoculation.

Direct coverslip preparations from the meninges showed no bacteria, but cultures in broth and on serum from the same source showed a few colonies of diplo-bacilli indistinguishable from those inoculated. Similar preparations from the heart's blood showed no growth.

Guinea pig No. 439, weight 455 grammes, was inoculated June 26, 1901, intraperitoneally, with 1 c.c. of an emulsion of a twenty-four-hour broth with a twenty-four-hour serum culture second from original diplo-bacillus, isolated from horn of heifer in case noted above. Also 0.4 c.c. of the same material as above was injected high into the right nostril. Animal still alive and well four months later, having exhibited no symptoms in the meantime. Animal was used for another purpose.

Guinea pig No. 440, weight 395 grammes, was inoculated June 26, 1901, intraperitoneally with 1 c.c. of an emulsion of a twenty-four-hour broth with a twenty-four-hour serum culture second from original diplo-bacillus isolated from hip joint of heifer in case noted above. Animal was also given 0.4 c.c. of the same material as above high into the right nostril. No symptoms having arisen four months later, the animal was used for another purpose.

It will be seen from the above inoculations:

(1) That the extremely short diplo-bacillus or dipococcus isolated from this case was similar to that isolated from the case noted in the last Biennial Report, page 453. If this organism is not a variety of *bacillus haemorrhagica septicaemiae*, it is closely related thereto.

(2) That this diplococcoid bacillus, when inoculated subdurally in guinea pigs and in one rabbit, produced inflammation of the dura, while in guinea pig No. 437, a catarrhal inflammation in addition was present in the peritoneum and intestine.

(3) Intraperitoneal inoculations in both guinea pigs and rabbits were negative except in rabbit No. 440.

(4) From all of the animals, rabbits and guinea pigs, that is, which died after inoculation with this organism, the organism was recovered in pure culture.

(5) While the above mentioned inoculations are interesting, they need to be supplemented by inoculations in cattle before any conclusions can be drawn therefrom.

Underwood, Otter Tail County—Oct. 24, 1901, Drs. Brimhall and Wilson visited the farm of Ole Hagan, four miles north of Underwood, Minn., and made an autopsy on the body of a two-year-old steer, dead sixteen hours previously from malignant catarrh.

In July, 1901, Mr. Hagan had lost a heifer with the disease. She had been in pasture in a herd two miles away from home, and when she became sick was brought home, where she died within a few days. She was kept while at home in an old shed near the barn. In August, another heifer died. She had been running in a field adjoining the shed and to which they occasionally had access. October 0th, the steer which was examined became sick. He also had been running with the cattle in the distant pasture, but had been with the home herd while both of the previously mentioned animals were sick. He died October 23rd, about 6 p. m. The weather at the time was cool and not much decomposition had set in when the examination was made, October 24th.

A very offensive discharge was present from the nostrils. On removing the lower jaw, the posterior pharynx was found to be studded with small ulcers and the whole surface covered with a yellowish, plastic, foul-smelling exudate. The horns were somewhat loose, and on removal showed the lining membranes very markedly inflamed. One hip joint, when opened, showed a large quantity of blood fluid within the cavity. There had been some inflammation of the pleura, peritoneum and pericardium.

Direct coverslip preparations and serum and broth cultures were made from the interior of the horn, eye chamber, pharynx, pleura, pericardium, gall bladder and hip joint. A piece of ulcerated tissue from the upper pharynx was placed in 96 per cent alcohol for histological study.

Direct coverslip preparations stained with eosin and methlyene blue from the interior of the horn and hip joint showed numerous small diplococci or diplococcoid bacilli. Those from the pericardial fluid and eye chamber showed the same micro-organism, and in addition, small, motile bacilli, probably *B. coli communis*. Those from the gall bladder and heart's blood showed *B. coli communis* (?) and a large putrefactive (?) bacilli. Those from the throat showed a great number and variety of bacteria.

Cultures in broth and serum from the interior of the horn and hip joint showed many small diplococci or diplococcoid bacilli similar to those found in the direct coverslip preparations. In addition the cultures from the horn showed a few large putrefactive (?) bacilli. Cultures from the pericardial fluid and the eye chamber showed the same diplococci or diplococcoid bacilli in small numbers and great numbers of the large putrefactive (?) organism as well as *B. coli communis*. Cultures from the heart's blood and gall bladder showed only *B. coli communis* and large putrefactive bacilli. Cultures from the throat contained a great variety of micro-organisms, though the diplococcus found in the horn, hip joint, eye chamber and pericardial fluid was apparently absent. Pressure of other work at this time prevented the making of animal inoculations.

St. Martin's Township, Stearns County—Feb. 6, 1902, Dr. Brimhall visited the farm of Mr. C. P. Rausch, St. Martin's Township, Stearns County, to investigate an outbreak of cattle disease. Mr. Rausch had originally a herd of fifty-seven cattle. During the month or two previous to Dr. Brimhall's visit, nine had died with symptoms similar to those exhibited by five others sick at the time of Dr. Brimhall's visit. About twenty-five of the cattle were kept in the stable. The others were kept in other places. None of those which had been kept outside of the stable had been sick at any time, though there were a number of steers of this group which ran with the sick cattle during the daytime.

One animal, cow No. 1, had been taken sick on February 4th, was seen on the evening of February 6th, when her temperature was 104.5°. There was profuse diarrhœa, discharge from the nose and eyes and the conjunctiva of the eyes were very much inflamed. Animal was very much emaciated, not having taken food since the first day of her sickness. On the morning of the 7th she was killed by a blow on the head and an autopsy made. There were no pathological lesions of any moment found except a slight catarrhal inflammation of the mucuous membranes throughout.

Cultures were taken from the anterior chamber of the eye, from the horn cavity, from pericardial sac, heart's blood, anterior mediastinal lymph gland, spleen, kidney, hip joint, the intérior of the uterus and from the udder. Also took an eye and lymph gland with capsule and portion of spleen and kidney. These were placed in Cohansey jars and small portions of the spleen, liver, kidney and lymph glands were placed in alcohol. These were all kept cool and brought to the laboratory and cultures placed in the incubator, at 1 p. m., Feb. 8, 1902.

Cultures were made from pieces of the spleen, kidney and eye and a gland brought to the laboratory by Dr. S. D. Brimhall; also smears. The smears stained with methylene blue and eosin showed no bacteria. After forty-eight hours the cultures showed no growth.

Of the cultures taken by Dr. Brimhall, at the autopsy, there was a growth of those from the eye, hip joint, milk, gland from the anterior media stinum, horn cavity and kidney. The growth from the eye showed a large clear-staining spore-bearing bacillus which liquefied serum. From the hip joint there was obtained a short, solid staining bacillus and a diplococcus or diplo-bacillus. A diplococcus or diplo-bacillus in pure culture was obtained from the milk and the gland from the anterior media-stinum. The growth from the kidney showed a granular staining bacillus somewhat resembling diphtheria bacilli. The growth from the horn cavity showed a large bacillus which liquefied serum.

Since a diplococcus or diploccoid bacillus had been found in other cases of malignant catarrh it was supposed that the diplobacillus was the pathogenic organism and the cultures which did not show the diplococcus or diplococcoid bacillus were set aside.

Rabbit No. 522, weight 1,527 grammes, was inoculated Feb. 15. 1902, in the left ear vein with 1 c.c. of a twenty-four-hour broth with a twenty-four-hour serum culture of the diplococcus obtained from the tissue of cow No. 1. This animal showed no symptoms during the ensuing two months, after which time it was used for another purpose.

Guinea pig No. 495, weight 557 grammes, was inoculated Feb. 15, 1902, intraperitoneally with 2 c.c. of a twenty-four-hour broth with a forty-eight-hour serum culture of the diplococcus isolated from the udder of cow No. 1. This animal showed no symptoms during the ensuing month.

Feb. 14, 1902, Dr. Brimhall again visited the farm of Mr. Rausch, where he found that three of the five cattle which had been sick on February 7th had died and that three others had become sick, two of which had died. Two of those which were sick at the time of Dr. Brimhall's first visit were now improving. One of these, cow No. 2, was killed and an autopsy made. The post-mortem findings were similar to those in cow No. 1. Direct coverslip preparations and serum cultures showed a small diplococcus or diplococcoid bacillus from the horn cavity and hip joint.

Rabbit No. 523 was inoculated Feb. 18, 1902, into the left ear vein with 1 c.c. of an emulsion of a twenty-four-hour broth and a twenty-four-hour serum culture of the organism from hip joint of cow No. 2. This animal showed no symptoms during the ensuing month, when it was used again for another purpose.

Guinea pig No. 498, weight 355 grammes, was inoculated intraperitoneally, Feb. 18, 1902, with 1 c.c. of an emulsion of a twenty-four-hour broth with a twenty-four-hour serum culture of the diplococcus isolated from the hip joint of Rausch cow No. 2. The animal showed no symptoms during the ensuing three months, at the end of which time it died of pneumonia during an epidemic among other guinea pigs in the same building.

At the time of Dr. Brimhall's first visit to Stearns County, he found that Mr. Anton Knese, living near Torah, had lost sixteen head of cattle with what he thought was the same disease as that causing the death of Mr. Rausch's cattle. Mr. John Loeckes had lost four head during the winter and Mr. Jos. Schaeffer lost eighteen head sometime before with what they thought was the same disease as had caused the death of Mr. Rausch's cattle.

It will be seen from the above that the investigation of these latter cases was somewhat unsatisfactory from the laboratory standpoint, since the materials were collected under unfavorable conditions and of the few inoculations that were made none proved to be successful. At the time the outbreak occurred, pressure of other work in the laboratory was so great that it was impossible for anyone to accompany Dr. Brimhall to collect specimens. At that time as well as during all previous investigations of this disease, the laboratory had at its disposal no place where large animals could be kept. It was therefore impossible to make inoculations of cattle as should have been done.

That the disease, malignant catarrh, is one which causes considerable loss to the farmers of Minnesota, there can be no doubt. This investigation should be persistently pursued at every opportunity. From the experience of this board, there would seem to be little hope of accomplishing anything concerning the etiology of the disease without the inoculation of bovines. Since the board has been in a position to make such inoculations, i. e., since Jan. 1, 1903, no cases have come to its attention.

SUNDRY DISEASES OF CATTLE.

Pleuropneumonia (?)—*Edmunds, S. D.*—June 22, 1902, there was received in the laboratory from Dr. J. P. Foster, State Veterinarian of South Dakota, specimens of lungs of cattle. Accompanying the specimen was the following data:

"I was called to inspect a herd of cattle in Edmunds County, S. D. The owner told me over the telephone that the cattle were affected with the following symptoms: Cough, nasal discharge, and great emaciation. I suspected tuberculosis even after seeing the cattle and before making a post-mortem. They are a lot of scrub stuff and were brought in from Sioux City about a year ago, when they were yearlings and were sold off in different bunches. As I understand it they were picked up in Minnesota and Iowa. I think they are skim milk calves of promiscuous breeding. The party who now has this stock got them in the herd in 1901, and at this time he noticed them coughing. Although they had the best of food all summer they steadily became poorer, and when seen by me a number of them were in bad shape. In starting them up they began to cough. The coughing is very husky. They also have a discharge from the nose on exertion. A number of them have died during the summer and fall, and the owner said they smelled very badly some time previous to their death.

"I made post-mortem examinations of two with the following results: Lungs in very bad shape, showing hepatized areas with very distinct lines of demarcation between the hepatized and normal lung tissue. These hepatized areas, some of which were about the size of a man's hand, were thicker than the healthy areas and bloated up at the line of demarcation. In cutting through the hepatized areas and squeezing the diseased portion a fluid oozed out of bronchioles which resembled somewhat the juice of milk-weed, but more yellow in color. The lining of the bronchioles was of a dirty gray color.

"The pleura was much thickened in spots and in some places there was air between the costal pleura and the lungs, so that it looked like a lot of bubbles, and at first glance resembled tuberculosis. There were numerous adhesions of the visceral and parietal pleura and also hydrothorax. There were no tubercular lesions whatever.

"I understand that there is another herd about five miles from this place where the cattle are affected in the same manner. They came from the same lot I believe, and were shipped in from Sioux City. This disease presents the lesions of pneumonia and pleurisy, and is undoubtedly contagious. Can it be possible that it is true contagious pleuropneumonia? The temperatures of these cattle were from 103.5° to 105°. I was careful to take the temperatures without exciting the animals; in fact, they were so weak that it was possible to get right up to them without their making much effort to run away."

In an additional note Jan. 21, 1902, Dr. Foster says: "The specimen of lungs and postmediastinal gland were taken from the same animal. The time was limited and we got the first one handy. The hepatization is not at all marked in this case. Neither do the lungs show the swollen hepatization, and the pleural adhesions are plainly seen. I enclose lymphatic gland as a possible aid to diagnosis. The pus formation is the only thing that might indicate tuberculosis in this case."

The specimens received at the laboratory were those described in the second note by Dr. Foster. The description in Dr. Foster's first letter was concerning specimens sent to the Bureau of Animal Industry. The specimens reached the laboratory in good condition on January 22. The lungs on section were found to contain little exudate.

Direct coverslip preparations from the lungs showed a large nonmotile bacillus which produced a white growth on agar and serum and a heavy creamy growth on potato and reddened litmus solutions. From the pus cavity a granular looking growth was obtained. This grew very rapidly on all media, produced no change in litmus media and no growth on potato. Celloidin sections of the edge of the abscess and also of the lung at some distance from the abscess were made. At the edge of the abscess there was an overgrowth of connective tissue, but with no infiltration of the tissues with polymorpho-nuclear leucocytes. The very thick mass of connective tissue which constituted the wall of the abscess showed upon its inner aspect some necrotic tissue. There were in it some areas of hyaline degeneration sharply marked off from the rest of the tissue. The alveolar walls in this neighborhood were all infiltrated with round cells and thickened. Both here and in the rest of the lung there was evidence of chronic bronchitis, and around some of the smaller bronchi peribronchitis. The alveoli were little changed and the pleura was not thickened. Apart from the abscesses then there was no evidence of inflammation, except of the bronchi. There was no hepatization of the lung.

Jan. 22, 1902, rabbit No. 511, weight 225 grammes, was inoculated intrathoracically with one c. c. of an emulsion of the lungs received from Dr. Foster. This animal showed no symptoms up to April 8, 1902, when it was used for another purpose.

Jan. 22, 1902, rabbit No. 512, weight 1,525 grammes, was inoculated intravenously in the external ear vein with 1 c.c. of an emulsion of the lung received from Dr. Foster. The animal was found dead on the morning of Feb. 8, 1902. At autopsy no gross lesions were found. Direct coverslip preparations in cultures from the various organs showed no bacteria.

It would appear from the above examination that the disease at least of the animal from which the specimens were received in the laboratory of this board was not contagious pleuropneumonia.

Infectious bronchopneumonia—*Zumbro Heights, Hennepin County.*—Oct. 2, 1902, Dr. Chas. E. Cotton brought to the laboratory a portion of lung, wrapped in a newspaper, and four test tubes, each containing a small amount of broth, and all unlabeled. Dr. Cotton said he had that day killed and made an autopsy on a calf, the property of Mr. L. of Zumbro Heights. The calf had been ailing for some time and at the time of killing showed only the lesions of a simple bronchopneumonia. The cultures had been made from blood, lung, spleen and liver, but since none of them were labeled it was impossible to distinguish the sources. Fresh cultures were made from the lung, which had been cut into in several places, and second cultures were made from the original broth cultures. All were placed in the incubator the same evening received. After 18 hours incubation cultures from the lung showed many diplococci and large spore-bearing bacilli. From each of the four tubes above noted (that is, from blood, lung, liver and spleen), many diplococci, staphylococci, *B. coli communis* and a small spore-bearing bacilli were obtained. Since the material had been so contaminated in the collection it was impossible to assign any etiological significance to any of the organisms. It is worthy of note, however, that only diplococci and large spore-bearing bacilli—evidently putrefactive—were obtained from the lung.

Mr. L. was advised to disinfect the quarters where the animals had been kept, on the possibility that the disease may have been an infectious pneumonia. He did so and the outbreak ceased.

Infectious Ophthalmia—*Near Walnut Grove, Lyon County, Minn.*—Aug. 30, 1901, Dr. Wilson visited the pasture of Mr. D. and Mr. S., near Walnut Grove, and collected specimens from the eyes of two head of cattle. There were about 600 head of cattle in the pasture. The owners thought that about 30 had been affected with an eye disease, but only two marked cases of blindness could be found in the herd at the time. Several of the animals had apparently recovered. The disease was apparently an infectious ophthalmia. Cultures were taken from the eyes of a black steer and a red cow. These were sown in plain broth and on serum and plain agar. After 48 hours in the incubator only staphylococci developed in broth and on serum from the eyes of the black steer. Similar cultures similarly grown from the eyes of the red cow developed staphylococci and streptococci in broth and a few scattered colonies on serum. The staphylococci in both cases on subsequent cultures proved to be staphylococcus pyogenes aureus. The streptococci failed to grow in second generation.

The convalescent stage of the disease, the limited number of animals examined, together with the apparent nonspecificity of the recovered organisms, furnished insufficient data from which to draw conclusions.

Infectious Ophthalmia—*Anoka County.*—Nov. 13, 1901, Drs. Brimhall and Wilson visited the farm of Mr. P., 23 miles north of Minneapolis, in Anoka County, and took cultures from the eyes of 19 calves, all of which, with a number of others, were exhibiting symptoms of an acute, apparently infectious and in most cases ulcerative ophthalmia of one or both eyes. The animals were in a herd of 50 or 60 spring calves and yearlings, almost all of which were or had been affected. They were in a run down condition of health, having been fed since failure of pasture on wild grass hay. They had had very poor care in general, the owner being absent and only careless and lazy attendants in charge. The animals were caught and a sterile cotton swab rubbed over the surface of the cornea or into the ulcer if present. This was then inoculated directly in the surface of Löffler's blood serum in 10 instances and into plain broth in nine.

A rather small diplococcus resembling in morphology gonococcus, was present in all of the 19 cultures. In the nine broth cultures, short chains of cocci in pairs of the size and general appearance of the diplococci already noted were also present. These were not seen in any of the serum cultures. They were probably the outgrowth of the diplococci as developed in broth, and could not be seen in cultures on solid media. In five of the nine broth cultures and in six of the ten serum cultures, a rather large staphylococcus was present. In six of the nine broth cultures, short, belted, bacilli or elongated diplococci were present. None were seen in any of the cultures or serum. In two of the broth cultures chains occurred of apparently these same bacilli. No such chains were found in any of the serum cultures. In one broth and in one serum culture, a rather short, slender, evenly staining bacillus with rounded ends was present. It did not appear in any of the other cultures.

It would appear from the above that the only organism constantly present was the diplococcus first described, with its possible variety, the streptococcus, described under broth cultures. Pressure of other work and lack of stabling accommodation for cattle prevented the immediate further examination of these cultures.

Mycotic Stomatitis—*Highmore, S. D.*—Feb. 11, 1903, Dr. Brimhall went to Highmore, S. D., to assist the authorities of that state in investigating an outbreak of disease of cattle which very much resembled foot and mouth disease.

About Christmas, 1902, one of these animals, which had previously been healthy (they all having been in quite good condition when brought in from the range some weeks before) became sick and died. The only symptoms observed were sore spots on the mucous membrane of the mouth and about the teats.

After the death of this animal and prior to Feb. 3, 1903, 10 other animals of the same herd died. In the meantime they had been running to water down a lane past the farm of Mr. B., whose cattle also went to water with them. On February 1st the herd of Mr. A. was separated from that of his neighbor and thereafter kept in a small enclosure away from all of the cattle. At the time of Dr. Brimhall's visit, February 12, 18 of the animals had died, a mortality of 37½ per cent. The owner thought that all the rest of the herd had had the disease in a mild form. None of the animals were showing any symptoms, except about eight, and these showed only small ulcers about the upper lip and dental pad. These were very irregular in form and some of the same animals had scabs upon the ends of the teats, and in one case there was an ulcer which was covered by a small scab upon the posterior part of the udder. There was also one other cow which had apparently recovered from the disease which showed scars on the teats, indicating that at some previous time they had been covered with sores.

On autopsy the animal from which the specimens were received showed the skin red about the right hind ankle (perhaps frost bite?). A few small collapsed areas in the anterior lobes of the lungs and also quite a number of well defined small hæmorrhagic areas in the right anterior lobe were present.

These areas were long and narrow, indicating the involvement of several lobules. On the surface of the breast bone and in the muscles of the chest were hæmorrhagic areas. Hæmorrhagic areas were also found on the spleen and one on the omentum about the size of a quarter of a dollar. Aside from this the other organs appeared healthy.

Although the disease resembled in many respects true foot and mouth disease, Dr. Brimhall was satisfied that it was not the same disease, but probably the disease described by J. W. Conway of Ohio and various other observers as mycotic stomatitis.

Feb. 14, 1903, Dr. Brimhall brought to the laboratory cultures in broth and a swab from the cow noted in the above autopsy. These cultures had been collected without proper apparatus, sterilization of the organ having been made by a burning pledget of cotton soaked in alcohol.

Cultures were made from lung, heart and spleen. After 48 hours in the incubator cultures developed as follows:

From the lung, short colon-like bacilli, some of which were almost diplococcoid. A number of sub-cultures were made from these cultures to determine if possible the presence of *B. bovisepticus*. Nothing except motile (colon) bacilli were obtained.

Heart's blood, no growth.

Spleen, long, slender bacilli and large thick, spore-bearing bacilli (both probably contaminations) and *B. coli communis*.

From the liver, *B. coli communis*.

Cultures were also brought to the laboratory at the same time by Dr. Brimhall from case No. 2, noted above. These had been made from the udder and teat of a living cow.

After 48 hours in the incubator cultures from both teat and udder showed only *staphylococcus pyogenes albus*.

Coal Tar (?) Poisoning—*East Chain Township, Martin Co.*—April 29, 1902, Dr. Annand visited the farm of Mr. S. C. McR. of Martin Co., Minn., to investigate a report of supposed hæmorrhagic septicæmia. April 22, the owner had made a watering trough, covering the boards with what he supposed to be coal tar (i. e. material in a tin can found by the owner when he first moved to the place). April 23 all of the stock (eight or 10), but one cow and the calves refused feed. Most of them showed some general weakness. The calves were taking milk and did not sicken. The owner gave all of the affected animals milk and linseed oil. One animal died on April 25 and another on April 28. On this last animal Dr. Annand made an autopsy. Decomposition had set in to some extent and a post-mortem examination was unsatisfactory. The stomach was inflamed and there was a slight congestion of the bowels. At the base of the brain was a hæmorrhage with surrounding congestion. From the condition of the stomach and the history of this ailment a provisional diagnosis of carbolic acid poisoning was made. Two portions of the spinal cord, together with pieces of lung, kidney, spleen and heart were removed and placed in formalin solution. A swab culture from the base of the brain was also taken.

On receipt in the laboratory, cultures from base of the brain were inoculated into fresh material. Only *B. coli communis* was present. Owing to the fact that the tissues had been placed in formaldehyde, it was impossible to make any cultures therefrom.

New Richland, Waseca Co.—(*Cattle*)—Dec. 8, 1902, there was received in the laboratory a small portion of tissue accompanied by the following letter:

> "This specimen of lung is from an eight months old calf. Please examine and inform me if it is dangerous to use the flesh, and oblige,
>
> E. E. VER PLANK."

Owing to the condition of the specimen when it was received in the laboratory no satisfactory examination was possible.

Eczema—*St. Cloud, Stearns Co.*—Feb. 7, 1903, during an investigation of swamp fever on the farm of Mr. H., 12 miles north of St. Cloud, Minn., the attention of Drs. Brimhall and Wesbrook was called to a condition present in a number of cattle on the place. Various areas of the bodies of the animals were covered with moist patches which resembled eczema. Close examination of the skin showed the presence of minute papillæ which, when scraped, left a bleeding surface. Later in the disease apparently the hair became loosened and could be readily pulled out, having at its roots a dry whitish material. The skin was thickened and involved over such bare areas.

A number of thoroughbred cattle were affected, amongst them a small male Shorthorn calf not quite one month old. This animal had the disease in its earliest stages and the hair was not loosened. Particurarly affected was the skin under the throat and later along the belly. From underneath the throat after clipping off the hair and scraping the surface with the blade of a scissors, a small piece of skin was snipped out and placed in Zenker's fluid for microscopic examination.

Some of the hair was forcibly pulled out with the material at its roots and with some of the scrapings of the surface of the skin were placed in a small coverslip box to be examined later.

Smears were made from the surface of the papillæ, whose edges had been scraped off for microscopic examination and a culture by means of a sterile swab was made from the area from which the skin had been removed with the scissors. This culture included the exudate from bleeding surface and scrapings of the cut edges.

Cultures gave a yellow and a white *staphylococcus* and a short thick, non-motile bacillus that grows with a transparent growth on agar, reddens dextrose and maltose agar and blues lactose and saccharose. No change in litmus milk. No protozoa were found on hair or scabs.

Streptococcus Infection—*Faribault, Rice Co.*—On Feb. 19, 1903, there was received in the laboratory a cow's foot and ankle from the School for Feeble Minded, Faribault, Minn., with the following history:

"She had been having this trouble for about nine weeks. First started on the upper margin of the cleft of the hoof. Later the leg was lanced. Cow lost strength rapidly and became greatly emaciated. One other cow showing same symptoms; that is, as far as lameness is concerned."

On February 20th this specimen was opened by Dr. Brimhall, exposing the sesamoid sheath, in which was a great quantity of purulent matter. A portion of the tendon was necrosed.

Cultures were taken from area close to the pus cavity and also from the pus itself.

Direct coverslip preparations stained with esosin and methylene blue showed many *strepto*-and *staphylococci* and small bacilli. Cultures in broth, on serum and on agar after 24 hours in the incubator showed *streptococci, staphylococci* and small motile bacilli, which on subsequent cultures proved to be *B. coli communis.*

MENINGITIS IN HORSES, CATTLE, SHEEP AND SWINE.

Introductory.—Meningitis in horses, cattle, sheep and swine has occurred in Minnesota in small isolated outbreaks a number of times during the last few years. The first outbreak investigated in detail by this board was that reported in the Biennial Report for 1898, page 180, in which an organism not distinguishable from *diplococcus intracelluiaris meningitidis, Weichselbaum*, was isolated from the central nervous system of a cow, the fifth to die on a farm near Rosemount. In the Biennial Report for 1899-1900, page 459, two other outbreaks in cattle were reported; one at the State Experiment Station, and the other near Lake Minnetonka. Both of these were shown to be due to *diplococcus pneumoniæ.* In the same report, pages 285 and 460, is recorded the history of an outbreak of meningitis in horses near Herman. These were typical cases (seven in all) in history, symptoms and lesions. The last inoculation experiment from this outbreak reported in the previous Biennial Report (see page 462, horse No. 3) was incomplete at the time of the writing of the report. The first portion of this experiment is herewith repeated in connection with the final results of the experiment.

Horse No. 3. Very old. Tested with mallein, May 25, 1900; no reaction. Inoculated into left carotid artery May 29th with 3.5 c.c. of twenty-four and forty-eight-hour broth culture, emulsified with twenty-four and forty-eight-hour serum culture of diplococcus of *Herman meningitis stock,* second culture from brain of horse No. 2.

Animal showed no symptoms up to and including June 15th, and remained well (no rise of temperature).

June 15, 1900, at 2:30 p. m., animal inoculated subcutaneously just back of left shoulder with 500 c.c. fourty-eight-hour plain broth culture of diplococcus from *Herman meningitis stock* "original." (Not passed through horse No. 2.) Also subcutaneously behind left shoulder with 500 c.c. forty-eight-hour plain broth culture of diplococcus from *Herman meningitis stock;* third culture from horse No. 2.

Friday, June 22nd, specimen of pus collected from abscess on left shoulder. Abscess had opened itself within the previous hour. Direct coverslip preparations showed abundant diplococci. No other micro-organisms observed.

Cultures on Löffler's serum and on plain broth after twenty-four hours in incubator showed only diplococci present."

Nothing further occurred until Sunday morning, July 8, 1900, when horse noticed by attendant to be apparently "off his feed." Sunday evening was down, making frequent efforts to rise, being apparently weak in his back. Was able to rise on his fore feet, but could proceed no farther toward getting up. Horse tried to eat while down. Temperature taken Tuesday, July 10th, at 3 p. m., subnormal. Animal found dead morning of Wednesday, July 11th, still warm.

Autopsy at 9 a. m. on the same day. Congestion of vessels, particularly the minute capillaries of the pia. No marked exudate in brain. Similar congestion in vessels of cord in cervical and lumbar regions. The left lung showed numerous small nodules, some of which contained a cheesy deposit surrounded by a tough capsule. One old scar and one nodule on the nasal septem. No ulcers.

Direct coverslip and serum and broth cultures were made from the meninges of (a) the superior surface of the cerebrum; (b) inferior surface of the temporal lobes; (c) cervical cord; (d) lumbar cord. Cultures also were taken from one nodule in lung.

Direct Coverslip Preparations.

(a) From superior surface of cerebrum showed no bacteria.
(b) From base of brain, a few diplococci.
(c) From cervical cord, many diplococci.
(d) From lumbar cord, few diplococci.
(e) From various nodules in lung, no bacteria.

Cultural Examinations.

(a) From superior surface of cerebrum, no growth either in broth or on serum.
(b) From base of brain, in broth fair growth; on serum, about twenty colonies of diplococci.
(c) From cervical cord, in broth, good growth; on serum, numerous isolated colonies, all diplococci.
(d) From lumbar cord, in broth, fair growth; on serum, about twenty colonies of diplococci.
(e) From nodule in lung, in broth, very abundant growth of small unevenly staining bacilli, probably *B. coli communis.*

The results of these two inoculations (see the above and horse No. 2, page 462, Biennial Report for 1899-1900) would seem to prove beyond a doubt the ætiological relationship of *diplococcus pneumoniæ* to the disease.

The following is a detailed statement of the examinations of cases of meningitis made from Jan. 1, 1901, to April 23, 1903:

Osakis, Douglas County (Horses)—Nov. 28, 1900, Dr. Brimhall visited the farm of Mr. F. P., near Osakis, Douglas County, to investigate the cause of death in horses. Mr. P. had lost four horses in a little over a week, and a fifth had been sick, but recovered. Those which died were sick from twenty-four to thirty-six hours. As they had all been dead several days, post-mortem examinations were out of the question, but from the description given by the owner, Dr. Brimhall felt certain that the cause of death was due to cerebrospinal meningitis.

Another man living about ten miles north of Osakis had lost five horses with what he thought was the same trouble, but they had been dying one at a time for a period of three months. The diagnosis was very doubtful.

Torah, Stearns County (Cattle)—On Jan. 12, 1901, there was received from H. Bouman, M. D., Torah, Minn., the head of a cow, the fifth to die on a farm near Torah. All the cattle except one were yearlings. They had been fed with corn stalks and unhusked corn. The symptoms noted were about the same in all animals. They refused to eat, showed great prostration and were unable to rise after the first day. The eyes were inflamed and swollen, with considerable discharge from both eyes and nose. There seemed to be marked fever, though temperatures were not taken. One died after two days' illness, three after three days' illness and one after two days' illness.

When the head was received in the laboratory it was in good condition and on opening the skull well marked meningitis was present. Diplococcus pneumoniæ was found abundantly in coverslip preparations and unmixed with other organisms in cultures.

Chanhassen Township, Carver County (Cattle)—Jan. 20, 1901, Dr. Brimhall visited the farm of Mr. A. H., Chanhassen Township, Carver County, to investigate the cause of death of Mr. H.'s cattle. Mr. H. had originally sixteen cows and two calves. Five of the cows had died after very short periods of illness, during which they showed rapidly ascending paralysis. One cow which had been sick and paralyzed so that she was unable to get on her feet had so far recovered at the time of Dr. Brimhall's visit that she was able to stand, though with difficulty. The owner gave a very clear description of the symptoms shown by cattle and Dr. Brimhall diagnosed the disease as cerebro-spinal meningitis. Isolation of the healthy cattle and disinfection of the stable was recommended. No further trouble from the disease arose.

Faribault, Rice County (Cattle)—June 21, 1901, Drs. Brimhall and Wilson, in company with Dr. L. Hay of Faribault, visited the farm of Mr. S., nine miles northwest of Faribault. About the first of April Mr. S. had lost a two-months'-old calf, which at that time was being fed on milk from the creamery. About a month later he lost a six-months'-old steer, and between that time and June 21 six other cattle, eight in all, had died. There were twenty-one animals originally in the herd. About half of them were cows and the remainder yearlings or six-months'-old steers and heifers. Five of the young cattle and three cows had already died. The owner said that all the animals exhibited practically the same symptoms. They first became somewhat stupid, had a wild staring look in the eyes and seemed slightly stiff in the back. After a short time they all became crazy, and rushed about the barnyard and attempted to bunt the other cattle and the owner. The posterior portion of the body then became paralyzed. Throughout the disease all the animals made frequent straining attempts to pass fæces; all had diarrhœa, which in most cases was bloody. The animals died in from one to four days after showing symptoms of the disease. The local "cow doctor" examined some of the sick animals and pronounced the disease diphtheria. About June 15, Dr. Hay saw one of the sick animals, which was almost dead at the time. He killed it and made an autopsy. He did not skin the carcass nor examine the central nervous system, but otherwise the autopsy was complete. No lesions were found except a slight degree of entero-colitis. June 21 a small red cow had been sick for two days, but the owner thought she was a little improved over what she had been the previous day. She presented a staring condition of the eyes with stiffness and slight incoordination of the hind legs. Her temperature was 102.5°. The owner was instructed to ship the head and neck, in case the cow died, packed in ice to the laboratory.

June 25, at 9 a. m., there was received in the laboratory a head of the small red cow described above. An examination was made at once by Drs. Brimhall and Wilson. On removing the skin a few small hæmorrhages were found in the subcutaneous tissue on sides and back of the neck. None were found on the under side of the neck. These may have been due to bruises received from the rope or chain with which the animal had been tied. The pharynx was markedly inflamed. On opening the skull the vessels of the pia were found engorged with blood and considerable pus was present in the sulci, especially near the base of the cerebrum. (All of the tissues were very nicely preserved; large cakes of ice were still present in the barrel containing the specimen when it was received in the laboratory.)

Direct coverslip preparations and broth and serum cultures were made from the hæmorrhagic subcutaneous areas and from various portions of the meninges. The upper two inches of the spinal cord divided into one-half inch segments with portions of the cortex of the left cerebrum were preserved in alcohol and formalin for histological examination. A portion of the medulla aseptically removed was used for inoculating rabbits Nos. 436 and 437. The direct coverslip preparations were stained with eosin and methylene blue. Careful search of all of them showed a few pairs of diplococci in those from the meninges. Cultures were examined after twenty-four hours in the incubator. Two broth and two serum cultures from the subcutaneous hæmorrhages developed no bacteria. Of the eight cultures from the various portions of the meninges, five—three broth and two serum—gave a growth of small, slowly growing diplococcus, which occasionally showed chains of four to eight individuals. No other bacteria were present in any of the cultures. Second cultures from the original ones from the meninges were sown heavily in the broth and on serum, and after twenty-four hours in the incubator were used for inoculation of rabbits Nos. 442 and 443, and of guinea pigs Nos. 441 and 442.

Rabbits Nos. 436 and 437 inoculated subdurally with an emulsion of the medulla of the cow noted above, died after six and eighteen days respectively, having shown symptoms of meningitis, viz., excitement, holding of head to one side, stupor and death. The symptoms had begun thirty-six hours after the inoculation. At autopsy no lesions were present except in the meninges, where the vessels were intensely congested, and some of the sulci near the base of the cerebrum contained a small amount of pus. Direct coverslip preparations and cultures in broth and on serum showed *diplococcus pneumoniæ*, apparently unmixed with other organisms.

Rabbit No. 442 was inoculated in the left subdural space with 0.2 c.c. of the emulsion of a twenty-four-hour broth with a twenty-four-hour Löffler's serum culture of the diplococcus, second from the original from the meninges of the cow, June 27, 1901. Only July 9, this animal began to show bilateral weakness of the muscles of the fore part of the body. There was no retraction of the head. The animal was found dead on July 11. At autopsy the meningeal vessels were found intensely congested, especially at the base of the brain. There was an increased amount of cerebro-spinal fluid. One small hepatized area was found in the right lung. The spleen was extremely small and of dark color. Direct coverslip preparations from the meninges showed diplococci. From the heart's blood no bacteria. Cultures in broth and on Löffler's serum showed many diplococci from the meninges. Those from the heart's blood gave no growth.

Rabbit No. 443 was inoculated intraperitoneally, June 27, 1901, with 1.5 c.c. of an emulsion of a twenty-four-hour broth with a twenty-four-hour serum culture of the diplococcus, second from original from meninges of cow, also 0.5 c.c. of the same material was injected into the right nostril. July 10, the first symptoms of meningitis appeared similar to those noted in rabbit 442. The animal died July 12. Autopsy showed intense congestion in the vessels and meninges of the skull. Congestion was most marked at the base of the brain. There was considerable increase of fluid in the ventricles. The spleen was almost completely atrophied. Direct coverslip preparations from the meninges showed a few diplococci from the heart's blood; no bacteria. Cultures in the broth and on serum from the meninges showed a slight growth of diplococci. Those from the heart's blood no growth.

Guinea pig No. 441 was inoculated June 27, 1901, in the left subdural space with 0.2 c.c. of the same material as that used in the inoculating of rabbits Nos. 444 and 443. The animal showed no symptoms at any time during the next succeeding six months, when it was used for another purpose.

Guinea pig No. 442 was inoculated June 27, 1901, intraperitoneally with 0.5 c.c. of the emulsion of the same material as that used for inoculating rabbits Nos. 442 and 443. The animal was also given 0.5 c.c. of the same material by high injection into the right nostril. This animal showed no symptoms during the ensuing six months, and it was then used for another purpose.

These several inoculations were undertaken to determine the possible presence of rabies virus. It would appear however that the early onset of the symptoms and death in rabbits 436 and 437; the production and symptoms of meningitis without posterior paralysis or retraction of the head by subdural and intraperitoneal injection of pure cultures of the diplococcus in rabbits 442 and 443; and the failure to produce any symptoms in guinea pigs Nos. 441 and 442 after similar inoculations with the same material; together with the uniform production of the lesions of meningitis and the multiplication of diplococcus pneumoniæ within the tissues of inoculated rabbits, would warrant the conclusion that the disease in the cow was meningitis due to *diplococcus pneumoniæ*, and unmixed with the virus of rabies or with other bacteria. This case would seem to be an important one owing to the difficulty sometimes experienced in distinguishing clinically between rabies and meningitis due to *diplococcus pneumoniæ*.

Lucas Township, Lyon County (Cattle)—Sept. 21, 1901, Drs. Annand and Wilson visited the farm of Mr. J. D. S., of Lucas Township, Lyon County, seven miles south of Cottonwood, Minn., to investigate an outbreak of an obscure disease. Mr. S. gave the following description of the cases: During the summer the cattle had been divided into two herds. A portion of them was kept on the farm on high rolling ground sown with rape. The other portion was in a large public grass pasture near Tracy. July 28, 1901, a cow on the home place was noticed to be sick, and died within twenty-four hours. Three weeks later or about August 18, a calf became sick and when apparently about to die on same day was killed. Three weeks after this, or about December 8, another cow became sick and died within twenty-four hours. One week later, or September 16, four young cattle, three of which had been brought back ten days previously from the pasture near Tracy, all became sick. Two of these at the time of the visit of Doctors Annand and Wilson were apparently better. The third was becoming slightly worse and the fourth was almost dead. The symptoms as described by the owner were refusal of food, trembling, bellowing, "drooling" from the mouth and an entire inability to swallow either food or water. One of the animals had been apparently blind. No bloody discharges were observed from any organs of any of the animals. The two yearlings which were apparently on the road to recovery seemed somewhat emaciated and had some difficulty in swallowing, but were able to chew their cud. The third spent most of the time at the watering tank with his nose immersed in the water and made a "champing" motion with his jaws as though attempting to get the water into his mouth. It seemed entirely unable to swallow. It was very much emaciated, the eyes being notably sunken. The fourth animal was down and apparently unable to rise. It was breathing in a jerky manner as though in pain. It made no attempt to swallow, though it frequently champed its jaws. There was considerable drooling from the mouth. (The temperature of all the animals examined was normal.) The animal was killed by a blow on the head and an autopsy made at once. Careful examination of the tongue and throat regions revealed no lesions except a slight congestion in the posterior nares and throat. One-half the animal's body as well as the whole of the neck was skinned, but no hæmorrhagic areas were found. A small slightly hæmorrhagic spot was found on the wall of the third stomach. The spleen was shrunken. A careful examination was made of all of the internal organs, and no other lesions were noted except that both kidneys were on the right side of the abdomen, an apparent anatomical anomaly. The condition of the central nervous system was somewhat disguised by the method of killing—blow on head—but so far as could be determined no evidence of meningitis was present. Direct coverslip preparations and cultures were collected from blood of the carotid artery, from lung, pericardial fluid, heart's blood, spleen, liver, and meninges.

One of the two serum cultures from the blood of the carotid artery developed one colony of streptococcus pyogenes aureus. The other culture and one of the two broth cultures remained sterile. The colony which developed may have come from the knife with which the artery was severed. The only other micro-organism found in any of the cultures was a large oval spore-bearing bacillus which grew at room temperature on the surface of one of the two serum cultures made from the liver. Another serum culture from the same source showed no bacteria. These cultures were made on the open prairie with the wind blowing a gale so severe that the alcohol blast lamp was frequently extinguished. No bacteria of any kind were found in any of the direct coverslip preparations.

Oct. 5, 1901, Drs. Brimhall and Wilson again visited the farm of Mr. J. D. S., and examined several cattle sick of the disease described above. No animals were dead and it was impossible to secure any for the purpose of autopsy. Careful study was made of the clinical symptoms and despite the previous negative bacteriological findings it was thought that the disease was meningitis.

The history of the onset of the disease and the symptoms in these cases point to infectious meningitis. The normal temperature and the apparent absence of specific bacteria from the tissues of the sick animal, however, make the diagnosis of an infectious meningitis doubtful.

Crow Lake Township, Stearns County (Cattle)—Feb. 26, 1902, Dr. Brimhall investigated an outbreak of cattle disease in Crow Lake Township, Stearns County, near Belgrade. Cattle on several different farms had been dying of the disease, which presented some obscure symptoms, but resembling those described in the preceding outbreak. No cattle were very sick at the time of Dr. Brimhall's visit and none could be obtained for autopsy. From the owner's description of the symptoms and from the symptoms seen by him, Dr. Brimhall was of the opinion that the cattle had been suffering from meningitis. Disinfection of stables, etc., was recommended and no more cases were reported.

Barden Township, Carver County (Swine)—Jan. 9, 1903, Mr. C. P. C. of Barden, Carver County, shipped to the laboratory three pigs of which he gave the following history: "The original litter contained nine pigs. They were born about Sept. 1, 1902, and had thriven well all the season until about the middle of December, when one was noticed having some trouble, which seemed like fits, coming on usually after they first came to the trough in the morning. They would get up to the trough and start to eat and then suddenly back up and sometimes would fall flat and breathe very hard with a grunting noise. This would last for an hour or more and then they would apparently be as well as ever. These spells became more frequent and longer in duration. The pigs died after about two weeks' sickness. Seven died, two were shipped to the laboratory along with a third healthy pig from another litter."

After arriving at the Laboratory of Animal Research the two sick ones showed spells similar to attacks of epilepsy, the smaller of the two having it much more severely. On this pig (No. 28 laboratory series), the following observations were made: The first attack came on the day after arrival and soon after having drunk water. The pig "backed up" and stood very stiffly. He made a peculiar grunting noise with each short, gasping respiration. This was quite typical of all the attacks, but after an attack which occurred on the 31st he breathed freely, but continued to show the short, grunting respiration. Animal was somewhat stiff all the time. Later the respiration seemed to improve, but the hind legs became weak and sufficiently paralyzed so as to prevent the animal from standing up. Temperatures were taken as follows: January 12, 103.8°; January 14, 103°; January 19, 104.3°. The pig was killed January 20 for the purpose of autopsy. No lesions were found except a small hæmorrhage in larynx at the side just above the cricoid cartilage. The pia at the base of the medulla was somewhat hæmorrhagic. Cultures from the lumbar cord and kidney showed no growth. Those from the medulla, liver, heart's blood showed diplococci; from the spleen a large nonmotile bacillus (probably a contamination).

Rabbits Nos. 664 and 684 were inoculated intravenously and subdurally respectively, with cultures of the diplococcus from this case, but showed no symptoms during the ensuing two months, after which time they were used for other inoculations.

The other sick pig, No. 30, laboratory series, presented much the same symptoms as its companion. January 12 its temperature was 104.8°; January 19, 104.6°. Died January 24. Autopsy showed no gross lesions except marked injection of the mesenteric vessels, a few collapsed areas in one lung and some evidence of meningitis. Cultures from the heart's blood showed no growth; from the kidney, liver and spleen streptococci in short chains; and from the meninges diplococci and streptococci.

From the facts above given it would seem that both pigs were suffering from infection of *diplococcus pneumoniæ* with a secondary infection of streptococci in one of the animals. The low virulence of the organism may account for the somewhat chronic nature of the disease. The cases are, however, too few to warrant the drawing of any sweeping conclusions.

Hayward Township, Freeborn County (Horses)—Jan. 8, 1903, Dr. Annand visited the farm of Mr. G. P. T., three miles east of Glenville, Minn., Hayward Township, Freeborn County, to investigate a disease of horses.

Beginning about three weeks prior to the onset of the first symptoms Mr. T. had fed his horses on ensilage. On opening the silo some of the material from the top had been found considerably decomposed. This had been forked off and scattered about the barnyard. When the horses were first put on the fresh ensilage they refused it, but after a little time began to eat it quite freely.

According to the history obtained from the owner, "one mare was noticed not right at 4 p. m. Jan. 2, 1903. First symptoms noticed were slobbering; about three hours later uneasiness in the stall; at 8 p. m. noticed that animal had lost power of deglutition. At the same hour noticed the animal trembling some. At 9 p. m. started to sweat, went down and unable to rise sometime between 10 and 11 p. m. When seen, paralyzed, tongue extended and the animal went from bad to worse until she died at 3 p. m., Jan. 3, 1903. This animal was seven years old and weighed 1,800 pounds. No post-mortem made."

The horse on which Dr. Annand held a post-mortem was noticed to be sick on Monday evening, January 5, and followed very much the same course as the other one except that it was not quite so aggravated, and died about 8 o'clock p. m., Jan. 7, 1903, after forty-eight hours' sickness.

Post-mortem made at 3 p. m., January 8. On cutting the animal open the first thing noticed was hydro-thorax and some fluid in the peritoneal cavity. The right lung was somewhat congested; the heart on one side seemed to be somewhat inflamed, but could not determine positively. It might have been hypostatic. The small intestines were somewhat injected and along the course of the mesenteric artery of small intestines there were bloody deposits. The liver was somewhat dark in color and quite easily torn. On opening up kidneys pustular matter was found in the pelvis. On removing the head a great amount of serum escaped and about the cord the meninges were more or less injected. On removing a portion of the spine in the sacro-lumbar region the vessels of the cord and its coverings were found much injected.

A portion of the lung, heart-wall, spleen, liver, kidney and spinal cord and the whole of the brain enclosed in the skull were brought to the laboratory in a frozen condition. Specimens were examined the morning of Jan. 10, 1903. The lungs showed small collapsed areas; the heart-wall showed a hæmorrhagic portion 1½x2 inches, very dark in color and evidently a lesion present before death. The cortex of the kidney was much congested. The meninges of the spinal cord and brain were congested but showed no pus.

Portions of tissue from each of the organs were preserved in 10 per cent formaldehyde and in 96 per cent alcohol. Cultures were made in broth and on serum from each of the organs, including both the meninges and white matter of the brain. After forty-eight hours in the incubator a growth was present in and on all of the cultures, excepting those from the brain substance which showed no growth on either medium.

After careful picking of colonies and sowing out on various media, the following organisms were isolated from the different sources:

Lungs.

(1) Streptococci in long chains; very numerous.
(2) Diplococci, apparently *diplococcus pneumoniæ.*
(3) *B. coli communis.*

Heart Wall. Streptococci only; long chains.

Spleen.

(1) Streptococci in long chains.
(2) Staphylococcus (albus?).

Liver. Streptococci.

Kidney. Streptococci.

Meninges of spinal cord. Streptococci, diplococci and large spore-bearing (putrefactive?) bacilli.

Meninges of brain.

(1) Streptococci and diplococci.

(2) Staphylococcus albus.

Brain substance. No growth.

At the time of Dr. Annand's visit another horse was sick. Temperature was 100.5°, respiration 22, pulse 58, mucuous membrane of eyes was somewhat injected.

Jan. 28, 1903, Drs. Brimhall and Wilson visited the farm of Mr. G. P. T. again. On arrival a seven-year-old gray horse, No. 29, Laboratory series, which had been sick for ten days was found down on its right side in the barn. The animal began ailing on January 11 and went down on January 18. The owner did not think until the horse went down that it was suffering from the same disease of which the others died. During this time Mr. T. had fed it gruel, milk, etc., from a bottle, it being unable to swallow coarse food. The animal was apparently unable to make even an effort to rise, though it was able to freely move both front and hind legs. It could raise its nose but not its head. Sensation seemed to be entirely absent over the posterior extremities. Temperature of this animal was 105.2° at 8:30 a. m., January 22nd. This was the fourth animal out of five which Mr. T. had lost, the second being the one from which specimens were collected by Dr. Annand, Jan. 8, 1903.

The third was the horse noted by Dr. Annand as becoming sick on January 8, and concerning which data was to be supplied by Mr. T. The animal died January 12. Shortly after Dr. Annand's visit two other horses were hired from a neighbor to do the work of the farm, but were kept in a shed apart from that in which Mr. T.'s horses had been sick. However, a door opened from this shed into the barn in which the sick horses had been kept.

Horse noted above was killed by bleeding, and an autopsy made at once. The throat, posterior pharynx and trachea were apparently normal. Lungs showed hypostatic congestion in the dependent portions, and a strip of consolidated tissue in the center of the anterior lobe about three inches long and one-half inch wide on the left side. Several areas of hæmorrhage from one-fourth to one inch in diameter were found under the endocardium. The spleen was small and rather dried than normal. The liver was apparently fatty. The intestines and mesentery were apparently normal except for the presence of several aneurisms containing worms,—*strongulus armatus*—in the mesenteric arteries. The kidneys were apparently normal—except for a clot—extracapsular—about the right (lower) kidney. On opening the spinal cord at the cervical region a large amount of reddish colored serum escaped. The meninges of the brain and cord were congested, but showed no pus. Congestion was most intense about the pons and base of the cerebrum. In the lumbar region of the cord small flakes of yellowish exudate *(fibrin)* were found attached to the pia of the cord.

Direct coverslip preparations, cultures and tissues for histological examination were collected from the trachea, lung, heart, spleen, liver, right hock and meninges of brain and spinal cord in the cervical and lumbar regions.

Direct coverslip prepartions stained with eosin and methylene blue on examination showed bacteria, as follows:

Lung. Diplococci.

Heart's blood. Negative.

Spleen. Negative.

Liver. Negative.

Right hock. Negative.

Meninges of brain. Diplococci (lanceolate, encapsulated, Gram-staining, some intracellular and some extracellular.)

Cervical spinal cord. Ditto.

Lumbar spinal cord. Ditto.

Cultures in broth and on serum after incubation showed bacteria as follows:

Trachea. Numerous large and small bacilli; staphylococci. (No diplococci.)

Lung. Diplococci.

Heart's blood. Negative.

Spleen. A few streptococci.

Liver. Negative.

Right hock. Negative

Meninges of brain. Diplococci (lanceolate Gram-staining).

Meninges of cervical spinal cord. Diplococci (lanceolate Gram-staining).

Meninges of lumbar spinal cord. Diplococci (lanceolate, Gram-staining).

The diplococci isolated from the meninges of brain and spinal cord and from the lung gave a turbid growth in broth and after twenty-four hours a slight precipitate. On agar, white isolated colonies about 0.5 mm. in diameter.

In and on litmus lactose and litmus dextrose agar colonies developed similar to those on plain agar. The acid reaction on these media was variable within narrow limits, but there was no formation of gas bubbles.

On serum the colonies were somewhat larger in diameter than on agar, pasty in appearance and of the color of the serum.

No visible change was produced in milk after eight days' growth in the incubator.

In gelatin stab cultures only a very faint growth took place along the needle track after eight days.

Rabbit 671 was inoculated intravenously with 0.3 c.c. of a broth culture, fifth generation of the diplococcus from this horse. Animal died after four days.

At autopsy many diplococci were found in the exudate from the meninges both within and outside of the leucocytes. One small focus of pus was present in the right lung. No other gross lesions were discoverable.

Rabbit No. 685 was inoculated February 28, in left subdural space with 0.2 c.c. with emulsion of the serum culture from this case. The animal began to exhibit symptoms of meningitis on second day after inoculation and died seven days later. Marked meningitis was present at autopsy and *diplococcus pneumoniæ* was recovered from the meninges.

There can be no doubt that these cases were *meningitis*, due to *diplococcus pneumoniæ*. The same train of symptoms has however been reported by Pearson* as being reproduced by him in horses by feeding with ensilage. Therefore, in order to determine whether the ensilage had anything to do with the direct production of the disease or with transmitting the organism to horses, the following experiments were conducted:

January 5 Mr. T. shipped to the laboratory in twenty-four sacks over one ton of the ensilage. Six of these sacks were filled with the half decomposed material described above, and the remaining eighteen sacks with good ensilage. The weather was cold at the time and the sacks were placed out doors, where they remained frozen for some time. They then thawed out and began to decompose and mould.

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*Pearson. Journal of Comparative Medicine and Veterinary Archives, 1900, volume XXI., page 654.

Experimental horse No. 12, a large, old, thin, but healthy horse, was placed in a box stall at the Research Laboratory of the board and given ensilage as follows:

Jan. 30, 1903, began feeding on good ensilage. No other feed was allowed. Horse at first refused ensilage, but later ate it sparingly. After two sacks of the good ensilage had been given the decomposed ensilage was substituted on February 5. One sack of this had been eaten by the horse by February 9. The animal at this time, however, had lost so much flesh that he was again placed on the better ensilage and a little corn was added to it. The ensilage and grain were made into a mash part of the time and part of the time the ensilage was fed by itself in a moist condition. The animal was kept on this feed until March 13, or forty-three days in all. During this time his temperature was taken twice daily, as follows:

1903.			1903.			1903.		
Date.			Date.			Date.		
Jan.	Hour.	Temp.	Feb.	Hour.	Temp.	March.	Hour.	Temp.
30.	5:15 p. m.	100	19.	5:00 p. m.	100.2	8.	9:00 a. m.	98.2
31.	9:00 a. m.	99.8	20.	9:00 a. m.	100.4	8.	5:00 p. m.	98.8
Feb.			20.	5:00 p. m.	100.2	9.	9:00 a. m.	98.4
1.	11:00 a. m.	100	21.	9:00 a. m.	100	9.	5:00 p. m.	98.2
2.	10:00 a. m.	99.4	21.	5:00 p. m.	100.2	10.	9:00 a. m.	98.2
2.	4:30 p. m.	99.6	22.	9:00 a. m.	100.4	10.	5:00 p. m.	98.8
3.	9:00 a. m.	99.1	22.	5:00 p. m.	99.4	11.	9:00 a. m.	98.4
3.	4:00 p. m.	100	23.	9:00 a. m.	99.2	11.	5:00 p. m.	98.2
4.	9:00 a. m.	100.4	23.	5:00 p. m.	99.2	12.	9:00 a. m.	98.4
4.	5:00 p. m.	100	24.	9:00 a. m.	99	12.	5:00 p. m.	98.4
5.	11:15 a. m.	99.6	24.	5:00 p. m.	99.2	13.	9:00 a. m.	98.2
5.	5:30 p. m.	100.2	25.	9:00 a. m.	98.8	13.	5:00 p. m.	98.2
6.	9:00 a. m.	98.8	25.	5:00 p. m.	98.6	14.	9:00 a. m.	98.4
6.	5:00 p. m.	99.4	26.	9:00 a. m.	98.8	15.	10:00 a .m.	98.6
7.	11:00 a. m.	98.9	26.	5:00 p. m.	98.4	15.	5:00 p. m.	98.4
7.	5:00 p. m.	99.4	27.	9:00 a .m.	99	16.	9:00 a. m.	98.6
8.	10:25 a. m.	99.4	27.	5:00 p. m.	98.6	16.	5:00 p. m.	98.2
9.	10:30 a. m.	99	28.	9:05 a. m.	98.6	17.	9:00 a. m.	98.8
9.	4:30 p. m.	99.4	28.	5:00 p. m.	98.8	17.	5:00 p. m.	98.4
10.	9:00 a. m.	99.6	March.			18.	9:00 a. m.	98.6
10.	4:30 p. m.	98.6	1.	9:15 a. m.	98.4	18.	5:00 p. m.	98.4
11.	10:30 a. m.	98.6	1.	5:00 p. m.	98.2	19.	9:00 a. m.	99.4
11.	4:30 p. m.	99	2.	9:30 a. m.	98.2	19.	5:00 p. m.	99
12.	10:25 a. m.	99	2.	5:00 p. m.	98	20.	9:00 a. .m	99.2
13.	10:30 a. m.	99.6	3.	9:00 a. m.	98.4	20.	5:00 p. m.	98.8
13.	4:45 p. m.	101.4	3.	5:00 p. m.	99.2	21.	9:00 a. m.	98.4
14.	4:15 p. m.	100.2	4.	9:00 a. m.	99	21.	5:00 p. m.	98.6
15.	10:00 a. m.	99	4.	5:00 p. m.	99	22.	9:30 a. m.	98.4
16.	10:00 a. m.	98	5.	9:00 a. m.	98.6	22.	5:00 p. m.	98.6
16.	4:45 p. m.	98.6	5.	5:00 p. m.	98.8	23.	9:00 a. m.	98.8
17.	10:00 a .m.	98.8	6.	9:00 a. m.	99	23.	5:00 p. m.	98.6
17.	4:30 p. m.	98.6	6.	5:00 p. m.	99.4	24.	9:00 a. m.	98.8
18.	10:00 a. m.	98.6	7.	9:00 a. m.	98.6	24.	5:00 p. m.	98.4
18.	5:00 p. m.	99.6	7.	5:00 p. m.	99	25.	9:00 a. m.	98.8
19.	9:00 a. m.	99.4						

The animal showed no symptoms whatever during the entire course of the experiment. During the latter part of the feeding he increased in flesh and his coat became quite glossy. After being kept under observation until March 25, the animal was used for another purpose.

Experimental horse No. 13. This animal was a large, old, sorrel horse, thin and weak, and somewhat lame in hind legs. The animal had been down in the stall two or three times before it was purchased by the laboratory. The feeding of good ensilage to this animal was begun Feb. 3, 1903, and after three days the decomposed ensilage was substituted for the good. This was kept up until February 10, when the animal, being in poor physical condition was given again good ensilage and a small grain feed added. It was kept on ensilage until March 5. During this time it exhibited no symptoms of any sort, but increased in weight. On February 22, the animal's temperature arose and remained up for three days without any assignable cause except indigestion. It was kept under observation until April 16, when it was used for another purpose. The temperature during this period is herewith appended.

During the month and a half of the experiment these two horses were given about one ton of the ensilage, one-half of which was in a decomposed condition.

	1903.			1903.			1903.	
Date. Feb.	Hour.	Temp.	Date. Feb.	Hour.	Temp.	Date. March.	Hour.	Temp.
3.	4:00 p. m.	99.8	17.	10:00 a. m.	99.6	1.	9:15 a. m.	99.6
4.	9:00 a. m.	98.2	17.	4:00 p. m.	100.2	1.	5:00 p. m.	100
4.	5:00 p. m.	100.3	18.	10:00 a. m.	98.8	2.	9:30 a. m.	99.4
5.	11:00 a. m.	99.8	18.	5:00 p. m.	100	2.	5:00 p. m.	100.6
5.	5:30 p. m.	100.4	19.	9:00 a. m.	100.2	3.	9:00 a. m.	99.4
6.	9:00 a. m.	100.2	19.	5:00 p. m.	99.8	3.	5:00 p. m.	100.2
6.	5:00 p. m.	100.2	20.	9:00 a. m.	100.6	4.	9:00 a. m.	99.8
7.	11:30 a. m.	99.2	20.	5:00 p. m.	100.4	4.	5:00 p. m.	100.2
7.	5:05 p. m.	100.2	21.	9:00 a. m.	100.4	5.	9:00 a. m.	100
8.	10:20 a. m.	99.4	21.	5:00 p. m.	100.4	5.	5:00 p. m.	100.4
9.	10:30 a. m.	100.4	22.	9:00 a. m.	101	6.	9:00 a. m.	100
9.	4:30 p. m.	99.6	22.	5:00 p. m.	103.2	6.	5:00 p. m.	100
10.	9:00 a. m.	99.4	23.	9:00 a. m.	103	7.	9:00 a. m.	99.8
10.	4:30 p. m.	100	23.	5:00 p. m.	104.6	7.	5:00 p. m.	100
11.	10:30 a. m.	99.8	24.	9:00 a. m.	104	8.	9:00 a. .m	100.2
11.	4:30 p. m.	99.8	24.	5:00 p. m.	104.2	8.	5:00 p. m.	100
12.	10:20 a. m.	100	25.	9:00 a. m.	103.4	9.	9:00 a. m.	99.8
13.	10:30 a. m.	99.4	25.	5:00 p. m.	102.8	9.	5:00 p. m.	100.4
13.	4:45 p. m.	100	26.	9:00 a. m.	100.6	10.	9:00 a. m.	99.4
14.	4:30 p. m.	100.2	26.	5:00 p. m.	101.2	10.	5:00 p. m.	99.8
15.	10:00 a. m.	99.6	27.	9:00 a. m.	100	11.	9:00 a. m.	99.4
16.	10:30 a. m.	99.4	27.	5:00 p. m.	100.8	11.	5:00 p. m.	99.8
16.	4:45 p. m.	99.6	28.	9:15 a. .m	101.2	12.	9:00 a. m.	100
			28.	5:00 p. m.	100.8	12.	5:00 p. .m	99.6

1903.			1903.			1903.		
Date. March.	Hour.	Temp.	Date. March.	Hour.	Temp.	Date. April.	Hour.	Temp.
13.	9:00 a. m.	100.2	24.	9:00 a. m.	100.4	4.	5:00 p. m.	100.4
13.	5:00 p. m.	100.6	24.	5:00 p. m.	100.2	5.	10:00 a. m.	100.2
14.	9:00 a. m.	100.4	25.	9:00 a. m.	100.4	5.	4:30 p. m.	100.2
14.	5:00 p. m.	.....	25.	5:00 p. m.	100.2	6.	10:00 a. m.	100.6
(No. temp.; floor oiled.)			26.	9:00 a. m.	100.2	6.	5:00 p. m.	101
15.	10:00 a. m.	100.2	26.	5:00 p. m.	100.2	7.	9:15 a. m.	100.2
15.	5:00 p. m.	100.4	27.	9:00 a. m.	100.4	7.	5:00 p. m.	100.6
16.	9:00 a. m.	100	27.	5:00 p. .m	100.2	8.	9:00 a. m.	100.4
16.	5:00 p. m.	100.2	28.	9:00 a. m.	100.6	8.	5:00 p. m.	100.4
17.	9:00 a. m.	99.8	28.	5:00 p. m.	101	9.	9:30 a. m.	100.4
17.	5:00 p. m.	99.8	29.	9:30 a. m.	100.6	10.	8:30 a. m.	100.8
18.	9:00 a. .m	100	29.	4:30 p. m.	100.4	10.	5:30 p. m.	100.2
18.	5:00 p. m.	100.4	30.	9:30 a. m.	100.8	11.	8:15 a. m.	100.4
19.	9:00 a. m.	99.8	31.	9:30 a. m.	100.4	11.	5:00 p. m.	100.2
19.	5:00 p. m.	100.6	31.	5:00 p. m.	100	12.	10:00 a. m.	100.8
20.	9:00 a. m.	100.4	April.			12.	4:30 p. m.	100.4
20.	5:00 p. m.	100.4	1.	9:15 a. m.	100.4	13.	5:00 p. m.	100.6
21.	9:00 a. m.	100.2	1.	5:00 p. m.	100.2	14.	8:45 a. m.	100
21.	5:00 p. m.	100	2.	9:15 a. m.	100.2	14.	5·00 p. m.	100 6
22.	9:30 a. m.	99.6	2.	5:00 p. m.	100.2	15.	9:00 a. m.	101
22.	5:00 p. m.	100.6	3.	9.15 a. m.	100	(Down in stall.)		
23.	9:00 a. m.	100	3.	5:00 p. m.	100.4	15.	5:00 p. m.	100.6
23.	5:00 p. m.	100.4	4.	9:30 a. m.	100.6	16.	9:00 a. m.	100.2

Beaver Creek Township, Rock County (*Horses*)—Sunday, Jan. 18, 1903, Dr. Brimhall visited the farm of S. Bros., Beaver Creek Township, Rock County, eight miles west of Luverne, Minn. He found a two-year-old gray roan filly up in slings. This animal, noted as No. 31, in laboratory record, was taken sick January 17, and was unable to get up without help, but after being lifted with the slings was able to stand without much difficulty. When taken out of the slings walked without showing any special weakness. The only way inco-ordination showed was when the animal was turned shortly. It ate with difficulty. Coarse food was partially masticated and allowed to drop from the mouth, but it was able to soften the oats sufficiently to permit of their being swallowed. Drinking was difficult also.

Temperature 101.2°, pulse about 45. By artificial light the pupils were apparently not as sensitive as they should be, but when the horse was led into the sunlight they contracted normally. A large number of *stronguli̦s tetracanthis* were noticed attached to the movement from the bowels.

This horse was found dead in the slings on the morning of Thursday, January 22, the owners not having noticed any change in its condition on the night previous. The head and a portion of the backbone were packed and sent to the laboratory.

The specimens when received in the laboratory were all very solidly frozen. On examination the meninges of both brain and cord appeared to be intensely congested.

Cultures were made from the meninges of brain and cord and from the substance of the brain. After incubation the following bacteria were obtained:

1. *Meninges of brain.* Large spore-bearing bacilli and diplococci (*diplococcus pneumoniæ*).
2. *Brain substance.* Large spore-bearing bacilli and diplococci (*diplococcus pneumoniæ*).
3. *Meninges of cord.* Large spore-bearing bacilli and diplococci (*diplococcus pneumoniæ*).

On Jan. 27, 1903, Dr. Brimhall, accompanied by Dr. Wilson, again visited the farm.

On inquiry it was found that S. Bros. had lost in the latter part of March, 1902, two horses which exhibited symptoms similar to those above described, though they died in less than two days after the onset. The horses which died in March, 1902, had been running in a barnyard with cattle, hogs and other horses. Shortly after the death of the two animals the other horses were removed from the barnyard. All the horses in the spring of 1902 were drinking from a small creek, the water of which was very foul with decaying vegetation. Later in the spring the barnyard was cleaned up, the horses turned into pasture and a new water supply secured from a deep well. No more trouble occurred until December, 1902, when a horse became suddenly sick showing difficulty in swallowing; went down on December 20, and died December 21.

December 31 another animal became sick and died January 3, 1903. January 4, 1903, a blind mare which had been kept in the stable and led to water became sick and died in about thirty-six hours after the onset of symptoms. She was very violent, struggling severely from the first. Jan. 10, 1903, another animal, which had had a subnormal temperature two days before, died. The next horse to become sick was No. 31, seen by Dr. Brimhall. The horses were all being fed on grain, clean hay and straw. There was no ensilage on the place.

January 27, three horses were sick and down with the disease. One seven-year-old gray horse was taken sick January 25, and went down January 26. This is designated No. 32 in these notes. The second, a buckskin colored yearling colt, became sick the morning of January 26, and went down in a few hours after first symptoms appeared. This one is designated as No. 33 in succeeding notes. The third, No. 34, an iron gray yearling colt, had appeared to have some difficulty in chewing and swallowing in the afternoon of January 26, and was found down on its side but able to rise with assistance in the evening. The following morning, January 27, it was down and unable to rise. The temperature of these horses was taken by Dr. Brimhall:

Horse No. 32, 99.6°.
Horse No. 33, 99.2°.
Horse No. 34, 98°.

These animals were all lying out doors, exposed to the cold wind. No. 34 was shivering at the time.

Autopsy Notes, (Horse No. 32).—The animal was killed by bleeding and an autopsy made at once.

Throat and pharynx were found normal. The lungs showed hypostasis in dependent portions. On the upper right lung a large blood stained area was present. On cutting into this the staining was found to be very superficial. The horse had been lying on this, the right side, on the previous day and had been turned over. The staining was probably the remains of hypostasis which had been almost eradicated by the change in position.

The epicardial surface of the heart showed considerable roughening or pitting. There was no change of color about these roughened areas and no deposits of fibrin. The heart in its pericardium had been exposed for some time to a cold wind before the pericardium was opened. This apparent roughening may have been caused by chilling of the tissue before it was completely dead. Several small hæmorrhagic areas were found in the endocardium. The spleen was small, tough and dry; normal in color. The liver was yellowish and fatty in appearance. It also showed small petechial hæmorrhages scattered over the surface. The alimentary canal and mesentery were apparently normal except for the presence of aneurisms containing *strongylus armatus* within the mesenteric arteries. The stomach contained large numbers of bots. Kidneys were apparently normal except for a small collection of serum extracapsular about the right one. The frontal sinuses were opened and the lining found to be apparently normal. On opening the spinal canal in the cervical region a large quantity of yellowish serum flowed out. The meninges of both brain and cord were markedly congested. No pus was present. Considerable fibrin was adherent to the occiput about the foramen magnum extra-durally.

The base of the cerebellum and region of the pons showed the greatest congestion. The auditory nerves were apparently fatty in almost all their bundles.

Direct coverslip preparations, cultures and tissues for histological examination were collected from lung, heart, spleen, liver, kidney, frontal sinuses, brain, cervical and lumbar spinal cord.

Direct coverslip preparations stained with eosin and methylene blue showed bacteria as follows:

Lung. No bacteria.

Heart. No bacteria.

Spleen. No bacteria.

Liver. No bacteria.

Kidney. No bacteria.

Frontal sinus. No bacteria.

Meninges of brain. Lanceolate, encapsulated, Gram-staining diplococci, some intra- and some extra-cellular.

Meninges of cervical cord. Lanceolate, encapsulated, Gram-staining diplococci, some intra- and some extra-cellular.

Meninges of lumbar cord. Lanceolate, encapsulated, Gram-staining diplococci, some intra- and some extra-cellular.

Cultures in broth and on serum after incubation showed bacteria as follows:

Lung. No bacteria.

Heart. No bacteria except one broth culture in which a large spore-bearing bacillus was found (probably a contamination).

Spleen. No bacteria.

Liver. No bacteria.

Kidney. No bacteria.

Frontal sinus. No bacteria.

Brain. Diplococci indistinguishable from those described under case No. 29. See page 155 (*Diplococcus pneumoniæ.*)

Cervical cord. Diplococci indistinguishable from those described under case No. 29. See page 155. (*Diplococcus pneumoniæ.*)

Lumbar cord. Diplococci indistinguishable from those described under case No. 29. See page 155. (*Diplococcus pneumoniæ.*)

Autopsy Notes (*Horse No.* 33).—The colt was killed by bleeding and an autopsy made at once.

The throat, pharynx and trachea were apparently normal. Lung was normal. Heart showed small hæmorrhages in endocardium. Spleen small in size, normal in color, tough and fibrous. Liver was fatty. Stomach contained bots. The remainder of the alimentary canal was normal. The mesenteric arteries contained several areas in which the walls were roughened and thickened due to the presence of *strongylus armatus.* The kidneys were normal. On opening the spinal canal in the cervical region a large amount of yellowish serum escaped. The meninges of the brain and spinal cord were markedly congested, especially about the cerebellum and pons. The frontal sinuses were examined and found to be apparently normal.

Direct coverslip preparations, cultures and tissues for histological examination were collected from the lung, heart, spleen, liver, kidney, frontal sinuses, brain and cervical and lumbar cord.

Direct coverslip preparations stained with eosin and methylene blue showed bacteria as follows:

Lung. No bacteria.
Heart. No bacteria.
Spleen. No bacteria.
Liver. No bacteria.
Kidney. No bacteria.
Frontal sinus. Small, slender bacilli.
Meninges of brain. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ).*
Cervical and lumbar cords. Diplococci indistinguishable from those described under case No. 29. See page 155. (*Diplococcus pneumoniæ*).

Cultures in broth and on serum on examination showed bacteria as follows:

Lung. No bacteria.
Heart. No bacteria.
Spleen. Small streptococci.
Liver. No bacteria.
Kidney. No bacteria.
Frontal sinus. Small, slender motile bacilli.
Meninges of brain. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ)* and a few colonies of streptococci.
Cervical spinal cord. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ)* and a few colonies of streptococci.

Lumbar spinal cord. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ)* and a few colonies of streptococci.

February 28, rabbit No. 689 was inoculated in left subdural space with 0.2 c.c. of an emulsion of water of condensation of the serum culture, second from horse No. 33. The animal was exhibiting marked symptoms of meningitis on the morning after inoculation and was dead by evening of the same day, March 1.

March 3, 1903, a pig (No. 1), weight about 50 pounds, was inoculated subdurally over the lumbar cord with about 7 c.c. of the emulsion of a 24-hour broth and a 24-hour serum culture, originally from rabbit No. 689. Four hours after the inoculation the pig began to be excited; ran about the stall for some time, then became partially paralyzed in the posterior extremities and though still excited was unable to drag itself about the stall. It was found dead on the morning of the day following the inoculation. On laying bare the spinal cord and brain, the spinal canal was found to contain a large excess of fluid. The pia of both cord and brain was intensely congested. Direct coverslip preparations and cultures from the meninges of cord and brain showed *diplococcus pneumoniæ* in abundance unmixed with other organisms.

March 6, 1903, at 10:20 a. m., experimental horse No. 15 was inoculated by lumbar puncture through the dura of the spinal cord with 7 c.c. of a broth culture second from experimental pig No. 1 and (horse) meningitis case No. 33.

This animal had been under observation in the laboratory for 14 days, during which time his temperature had been taken twice daily and had varied from 98.8° to 100°. The animal was in perfect health at the time of the inoculation. The following notes of his symptoms are herewith given.

Inoculated 10:20 a. m., 10 c.c. emulsion.

1903. Date. March.	Hour.	Temp.	
6.	12:00 m.	100	Fed. Did not eat.
6.	1:00 p. m.	100.2	Trembling.
6.	1:20 p. m.	.....	Trembling. Respiration 24, in co-ordination.
6.	2:30 p. m.	.....	Water coming from nose in drops.
6.	3:30 p. m.	103	Unable to stand still. Respiration 56.
6.	4:20 p. m.	.....	Wet with perspiration. Respiration 48.
6.	5:00 p. m.	103	Repiration 48. Very restless on forefeet. Sensitive to touch. No urine or fæces voided since inoculation.

Date. March.	Hour.	Temp.	
7.	7:30 a. .m	102.2	Not so restless. Stronger on his legs.
7.	9:00 a. m.	102.4	Unable to put down his head to drink.
7.	1:00 p. m.	102.6	Eats grain and hay.
7.	5:00 p. m.	102.6	Milky substance running from nostrils.
8.	9:00 a. m.	102.6	Still nervous. Eating well.
8.	5:00 p. m.	102.2	Nervous. Eats oats and a little hay.
9.	9:00 a. m.	101.6	Heavy perspiration on sides and flanks, spasmodic jerking of flanks.
9.	5.00 p. m.	102.4	Still nervous. Eats hay. No oats.
9.	7:50 p. m.	.....	Down on right side, kicking vigorously, apparently in pain.
10.	8:00 a. m.	.....	Found dead.

Autopsy made at 9 a. m., body still warm.

On removing the skin, several small hæmorrhages were found in the subcutaneous connective tissue. The lungs showed some congestion, probably hypostatic.

The heart showed small hæmorrhages in the anterior auriculo-ventricular groove.

Spleen was normal in consistency and size. Weight, three pounds.

Liver normal in appearance. Weight, 15 pounds.

Intestines apparently normal. Large aneurism filled with strongyli in the middle mesenteric artery.

Kidneys apparently normal. Weight of left kidney, one and three-quarters pounds.

On opening the spinal canal and the dura, the subdural space was found filled with a hæmorrhagic exudate. This was most marked in the lumbar region several inches above and below the point of injection, but extended in a lesser degree to the cervical region. The meninges of the brain especially at the base were also markedly inflamed.

Direct coverslip preparations, cultures and tissues for histological examination were collected from lung, heart, spleen, liver, kidney and sacral, lumbar, and cervical spinal cord and meninges of brain.

Direct coverslip preparations from meninges of the spinal cord stained with eosin and methylene blue showed large diplococci, indistinguishable from those inoculated. After 48 hours in the incubator cultures gave results as follows:

From the lung, heart, spleen, liver and kidney, no growth.

From the meninges of the spinal cord at the site of inoculation, four inches back of the site of inoculation, 10 inches in front of the site of inoculation, cervical region and the meninges of the brain, all gave apparently pure cultures of a large Gram-staining diplococcus indistinguishable from that inoculated—(*diplococcus pneumoniæ.*)

Autopsy Notes (*Horse No.* 34).—Animal was killed by bleeding and an autopsy made at once.

Throat, pharynx and trachea normal Lungs normal. Endocardium showed small hæmorrhages. The spleen was small and tough; normal in color. Liver fatty. Stomach contained bots. The remainder of the alimentary canal showed no lesions. The greater mesentery showed an enlargment about four inches in length containing dark colored fluid and a number of immature worms (*strongylus armatus*). Kidneys were normal. Frontal sinuses were normal. Upon opening the dura in the cervical region of the spinal cord a large amount of bloody serum flowed out. The meninges of the brain and spinal cord were congested, markedly so about the base of the cerebellum and pons. Direct coverslip preparations, cultures and tissues for histological examination were collected from the lungs, heart, spleen, liver, kidneys, frontal sinus and brain and cervical and lumbar regions of the spinal cord.

Direct coverslip preparations stained with eosin and methylene blue on examination showed bacteria as follows:

Lungs. No bacteria.

Heart's blood. No bacteria.

Spleen. No bacteria.

Liver. No bacteria.

Kidney. No bacteria.

Frontal sinus. Staphylococci.

Meninges of brain. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ)*.

Cervical spinal cord. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ)*.

Lumbar spinal cord. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ)*.

Cultures in broth and on serum on examination showed bacteria as follows:

Lungs. No bacteria.

Heart. No bacteria.

Spleen. No bacteria.

Liver. No bacteria.

Kidneys. No bacteria.

Frontal sinus. Staphylococcus pyogenes albus.

Meninges of brain. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ)*.

Cervical spinal cord. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ)*.

Lumbar spinal cord. Diplococci indistinguishable from those described under case No. 29. See page 155. *(Diplococcus pneumoniæ)*.

Feb. 9, 1903, rabbit No. 672 was inoculated in left ear vein with 0. 3 c. c. with broth culture of *diplococcus pneumoniæ* from this case. The animal exhibited no symptoms during the ensuing two months, when it was used for another purpose.

Later S. Brothers reported the death of two more horses during the month of February from the same disease.

It will be seen from the above notes that *diplococcus pneumoniæ* was recovered unmixed with other organisms from the central nervous system of all of the horses examined in this outbreak; that it was inoculated in pure culture into rabbits, one pig and one horse; that in each of these animals symptoms and lesions of meningitis with death were produced; that the organism was recovered unmixed with other bacteria at autopsy of each of the animals. The demonstration of the etiological significance of the diplococcus pneumoniæ in these cases would therefore seem to be complete. It may be noted that none of the horses in this last described outbreak had ever been fed on ensilage, but had been on good hay and grain, and well cared for.

Lebanon Township, Dakota County, (*Sheep*)—March 18, 1903, Dr. Annand visited the farm of Mr. D. D., in Lebanon Township, Dakota County, near Rosemount, and investigated an outbreak of a disease among sheep. The first symptoms the sheep showed were a drooping of the head and listlessness. "Later they would elevate the head quite suddenly and hold it in the air for a while. In a couple of days they would go down and be unable to rise. While down they would keep the head extended as far back as possible. They had lived from three days to two weeks after getting sick. There was only one that had made what seemed to be a partial recovery. This was able to rise and move about, but had taken a relapse." Eight out of a herd of 60 had been lost. Dr. Annand made autopsies on two of the animals and brought material to the laboratory for examination. There was inflammation of the meninges and the gray matter of the spinal cord. At the base of the brain there was considerable inflammation. Externally the surface of the brain was very highly congested. On cutting into the cord some fluid was discharged.

Sheep 1.—Smears from the meninges stained by eosin and methylene blue showed what appeared to be large and small bacilli, possibly diplococci.

Cultures from the liver gave a diplococcus in pure culture (*diplococcus pneumoniæ*). Cultures from the heart and meninges gave colon bacilli. No growth from any of the other cultures.

Sheep 2.—Cultures from meninges gave *diplococcus pneumoniæ* in pure culture. Cultures from the spleen gave *diplococcus pneumoniæ* and a white staphylococcus. No growth from any of the other cultures.

TABLE SHOWING ANIMALS DEAD OF CEREBRO-SPINAL MENINGITIS FROM 1898 TO APRIL, 1903.

HORSES.

No. of Outbreak.	Date.	County.	Animals Sick.	Animals Dead.
*1.	June, 1899	Grant	6	6
*2.	June, 1900	Ramsey	1	1
*3.	Nov., 1900	Douglas	5	4
4.	Jan., 1903	Freeborn	5	5
5.	Jan., 1903	Rock	12	12
			29	28

CATTLE.

No. of Outbreak.	Date.	County.	Animals Sick.	Animals Dead.
*1.	Sept., 1898	Dakota	5	5
*2.	June, 1900	Ramsey	1	1
*3.	Sept., 1900	Hennepin	3	3
4.	Jan., 1901	Stearns	5	5
5.	Jan., 1901	Carver	6	5
6.	June, 1901	Rice	9	9
7.	Sept., 1901	Lyon	7	5
8.	Feb., 1902	Stearns	..	..
			36	33

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*These cases have been reported in the Biennial Reports of this Board for the years indicated by their dates.

SHEEP.

No. of Outbreak.	Date.	County.	Animals Sick.	Animals Dead.
1.	Mar., 1903	Dakota	8	8

SWINE.

No. of Outbreak.	Date.	County.	Animals Sick.	Animals Dead.
1.	Jan., 1903	Carver	9	9
15.			82	78

Summary.—1. The preceding detailed statement and table show that from September, 1898, to April, 1903, this board has investigated five outbreaks of cerebro-spinal meningitis in horses, eight in cattle, one in sheep and one in swine, making 15 outbreaks in all. These have been distributed in 11 counties. Of the 29 horses sick of the disease, 28 have died. Of the 36 sick cattle, 33 have died. All of the eight sheep and nine swine sick of the disease died, making a total of 82 sick animals with 78 deaths, or a mortality of about 95 per cent.

2. The symptoms may be summarized as follows:

Horses.—There was usually "slobbering" at the mouth, uneasiness, loss of power of deglutition, posterior inco-ordination, gradual posterior paralysis, rapidly ascending, and rapid loss of sensation over posterior extremities. In some instances evidence of involvement of the meninges of the brain was shown by frenzy and failure of pupils of eyes to react to light. Temperatures ran as high as 105° F., but dropped to normal or sub-normal as paralysis ascended.

Cattle.—In most of the cattle examined the symptoms indicated early brain involvement. The animals, at first somewhat stupid, but with a wild staring look in the eyes, shortly became frenzied and rushed about the enclosure attacking other animals. The pupils failed to react to light and some of the animals became, apparently, completely blind. After a short time, the posterior extremities showed inco-ordination, which was followed by both motor and sensory paralysis, which progressed to the death of the animal.

Sheep.—In the only outbreak observed among sheep, the symptoms began with listlessness and drooping and shaking of the head. After a little while the animals became unable to stand. When lying down the head was retracted as far as possible. Animals died after an illness lasting from two to 14 days.

Swine.—In the only outbreak observed in swine, the disease took a sub-acute course. The animals had recurrent "fits," during which time they had short gasping respiration and paralysis of the posterior extremities. The attacks became more frequent and longer in duration after a few days until the animals were continually paralyzed. The paralysis slowly increased and the animals died after about two weeks' illness.

3. No significant lesions were found at autopsy in any of the animals except in the central nervous system. In horses, on opening the spinal canal, a large amount of yellowish or red colored serum escaped. In several cases a quantity of yellowish coagulated serum (fibrin) was attached to the pia of the cord and base of the brain. The meninges of both the cord and brain were uniformly congested, especially in the cervical region of the cord and about the base of the cerebrum.

In cattle, while there was some increase in the amount of cerebro-spinal fluid, it was not so markedly increased as in the horses. The meningeal inflammation was clearly observable. This was especially true of the base of the brain and upper spinal cord.

The same was true of the sheep and swine examined.

4. Of the nine horses on which laboratory examinations have been made, all have shown histological lesions of meningitis with the presence of diplococcus pneumoniæ in direct coverslip preparations, tissues and cultures from the central nervous system.

During the time that the examinations were being made on the above mentioned cases of meningitis in horses, cattle, sheep and swine, similar examinations were made on 16 cases of suspected meningitis in man. The strains of diplococci isolated from the human cases were carefully compared with those isolated from animals. It has been impossible to differentiate the organisms from diplococcus pneumoniæ obtained from human sources by cultural methods.* The variation in acid production and milk coagulation is not greater than between different strains isolated from human sources. When inoculated into rabbits, the organisms appear to have a uniformly less degree of virulence for these animals than do freshly isolated strains of diplococcus pneumoniæ from human sources. This variation, however, is not greater than the variation between different strains of diplococcus pneumoniæ from meningitis and pneumonia in man. Besides a number of rabbit inoculations, the ætiological relationship of diplococcus pneumoniæ to meningitis in horses has been further shown by its inoculation into three horses, one subcutaneously, and into the carotid artery, another lnder the dura of the brain and the third under the dura of the lumbar cord. All of these animals died after exhibiting symptoms of meningitis. At autopsy, the inoculated organism was recovered from the central nervous system unmixed with other bacteria.

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*For cultural characteristics see page 461 Biennial Report this Board for 1899-1900, and p 155 of this report.

It is worthy of note that one strain of diplococcus pneumoniæ originally from a *horse,* after a single passage through a rabbit, was inoculated into the dura of the lumbar cord of a *pig.* The pig died after exhibiting symptoms of meningitis and diplococcus pneumoniæ was obtained in direct coverslip preparations and cultures from the meninges of both cord and brain unmixed with other organisms.

It should be noted that of the five outbreaks of meningitis in horses, only one gave a history of ensilage feeding. It so happened that all the other animals were good horses and were being well cared for and fed on good sound grain or hay. About one ton of ensilage from the silo concerned in the one outbreak noted above, was fed to two horses in the Research Laboratory without the production of any symptoms of meningitis. In the same outbreak *diplococcus pneumoniæ* was isolated from both of the two horses examined.

Of the five cows on which laboratory examinations were made, histological lesions of meningitis were present in all. From one an organism closely resembling, if not identical with, diplococcus intracellularis in man, was isolated. From three of the others, diplococci indistinguishable from diplococcus pneumoniæ were found in the meninges of the brain and cord.

From the meninges of the two sheep examined, diplococcus pneumoniæ was isolated.

Cultures from the meninges of the two pigs examined showed diplococcus pneumoniæ.

5. The clinical diagnosis of meningitis due to diplococcus pneumoniæ in horses, cattle, sheep and swine would seem to be exceedingly difficult to make. The disease described by Pearson* as forage poisoning in horses apparently so closely resembles meningitis due to diplococcus pneumoniæ that it would seem that only a careful bacteriological examination would serve to differentiate the two. The differentation of the disease from rabies in cattle is practically

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*Journal of Comparative Medicine and Veterinary Archives, 1900, Vol.. XXI, P. 654.

impossible without a laboratory examination. The meningeal form of hæmorrhagic septicæmia in cattle (see page 113 of this report) does not ordinarily produce so much excitement as does meningitis in cattle due to diplococcus pneumoniæ, but where the meninges of the brain are early affected by *B. bovisepticus* (see *hæmorrhagic septicæmia* outbreak No. 75) the symptoms so closely resemble the symptoms caused by diplococcus pneumoniæ that a careful laboratory examination is necessary in order to differentiate the two.

In making post-mortem examinations of animals it must be borne in mind that the gross lesions of meningitis sometimes appear to be insufficient to account for the severity of the symptoms. The presence or absence of inflammatory changes or bacteria can frequently be determined only by histological and cultural examinations. If these are not carefully made, the meningeal character of a disease with suggestive symptoms cannot properly be excluded.

6. The treatment of meningitis as it has come under the observation of this board would seem to be of little avail.

7. The separation of the sick from the well animals and the careful disinfection with chemicals and by fire appear to be the most effective means of checking the progress of the disease in a herd.

8. In connection with meningitis in various animals, there had been planned in the laboratory a series of experiments consisting of cross inoculations and cross immunizations of various animals with cultures of diplococcus pneumoniæ from various sources, to determine the variation or identity of the infecting bacteria. In connection with this it was hoped that it might be possible to produce an immunizing serum by means of some of the strains virulent to larger animals.

CORN STOCK DISEASE IN CATTLE.

In past years the term *corn stock disease* has been applied in certain cases where one or several animals have been afflicted with a set of symptoms not well defined. The only basis for such a diagnosis has been that the animals, at the time of the outbreak, were running in standing corn stalks.

In Minnesota since the careful study of *hemorrhagic septicæmia* and of *meningitis in cattle* was taken up by this Board in 1901, cases have been found which were thought by the farmers to be corn stock disease, but which in every instance after a careful investigation has proven to be either *hemorrhagic septicæmia* or *meningitis.*

Although a close watch was kept by the veterinarians under this board during the period already referred to for this so-called corn stock disease, not a single case has been found. It would seem that if there is such a disease some cases should have occurred, for previous to 1901 the term was in constant use, as applicable to certain outbreaks of disease among cattle in Minnesota.

The natural conclusion must be that if there is such a disease among cattle, it does not exist in Minnesota at the present time. The inference may go even farther:—that there has been no such disease in the past, and that the name was an unscientific term used to cover a group of diseases that had not received proper investigation in Minnesota prior to 1901. (See pages 114-115 of this report.)

SHEEP SCAB.

This disease needs watching, lest it become more general throughout the state. The sheep industry is of great importance in Minnesota. The feeding of sheep for market is carried on to quite an extent at many shipping points.

The Bureau of Animal Industry has been of great assistance in tracing out this disease, for in the event of scabby sheep being sent to the great packing houses for slaughter the disease was at once recognized and the fact reported to this Board by the federal authorities. The federal report gave the name of the shipper, the point from which and to which the shipment was made, the numbers and owner of the cars in which the shipment was made, etc. With such reports from the federal authorities it has been an easy matter to trace the sheep to the owners or shippers.

The railroad officials appreciate their responsibility in handling these diseased sheep and have been ready and willing to assist in preventing their shipment. During the past two years the railroad agents have been furnished by the State Board of Health with affidavits to be filled out and signed at the time of shipment by the owner or shipper to the effect that the sheep were free from scab at the time of shipment and that they had not been in contact with other sheep affected with the disease.

The State Board of Health issued a circular on sheep scab which reads as follows:

Nature of the Disease.—The disease commonly known as sheep-scab is a contagious parasitic skin disease. The parasites or mites which cause this disease are so small that they are seen with difficulty by the unaided eye. These little parasites multiply with amazing rapidity. Their eggs hatch in from four to seven days and the young mites mature in about fourteen days. The irritation of the skin by these mites causes the formation of crusts or scabs and shedding of the wool.

Symptoms.—Sheep affected with sheep-scab (scabies) are uneasy, often biting their sides, pulling out tufts of wool and scratching themselves against fences or other objects. The loosened tufts of wool give the fleece a ragged appearance. As the disease advances, thick crusts or scabs form and the wool is removed over large areas, leaving the skin quite bare for a time. When the animals have been heated by exercise the itching sensation is increased.

How the Disease Spreads.—Healthy sheep will contract the disease by coming in contact with diseased ones or by being placed in yards or cars previously occupied by diseased sheep, unless the pens, yards or cars have been recently disinfected. Sheep should never be shipped in stock cars which have not been thoroughly cleaned. It is a good rule to always dip new sheep before putting them in pens with others.

Treatment.—The two dips approved by the Federal authorities (see regulations) are: (1) the tobacco and sulphur, or (2) the lime and sulphur dips. The tobacco and sulphur dip is probably best for general use by farmers. The dip should be made with a reliable extract of tobacco, which will make, when used according to directions, a solution containing not less than five one-hundredths of one per cent of nicotine. To the tobacco mixture always add two per cent flowers of sulphur.

Formula:	Extract of tobacco (of the required strength)...	2 lbs.
	Flowers of sulphur..............................	16 lbs.
	Water	100 gal.

When being used the dip should be kept at a temperature as near 110° F. as is possible, and should be frequently stirred. When the weather will permit, the sheep should be shorn before treatment is begun. Keep each animal in the dip two minutes and be sure that its head is thoroughly wet.

Always dip the entire flock.

After dipping, place the sheep in non-infected pens and repeat the dipping in from eight to ten days. The old infected pens should be thoroughly disinfected by first removing and burning all litter, then cover all interior surfaces, to at least five feet from the ground, with a coat of fresh whitewash.

A convenient and durable dipping vat for a small flock can be made of galvanized iron. One end of the vat should be made sloping, and it should be seven feet long at the top, five feet at the bottom, two feet wide and five feet deep. A dripping rack should be built the proper height, with floor arranged with cleats which will give the sheep a foothold, and side pieces which will conduct the dip which drips from the sheep, into the vat. In order to assist the sheep in getting into the rack, cleats should be nailed to boards, which can be placed in the sloping end of the vat and fastened to the rack. Until the sheep have become sufficiently dry, so that there is no dripping from the wool, they should be kept in a pen that is free from grass, hay or food of any kind.

There are two tobacco extracts on the market which have proved reliable: Skabcura and Black Leaf dip. They can be purchased from Noyes Bros. & Cutler, wholesale druggists, St. Paul, or from any reliable drug company. Always be sure to add two per cent flowers of sulphur to a dip made with any preparation of tobacco.

S. D. BRIMHALL, V. M. D.,
Director Veterinary Department.

March 3, 1902.

The rules relating to quarantine and its violation were also formulated and published. They read as follows:

1. Animals affected with sheep scab are hereby held to be affected with a contagious or infectious disease as designated by the law of this State

and the rules of the State Board of Health. All persons and corporations are hereby forbidden to transport such diseased sheep from any point outside the state to any point with the state, or from place to place within the state, except upon permission in writing from the State Board of Health.

2. Animals that may be reasonably supposed to be affected with sheep scab shall not be allowed to enter any stock yard or other public place where they may come in contact with healthy sheep or where healthy sheep are liable to be placed.

3. All outbreaks of suspicious skin disease among sheep must be quarantined and at once reported to the State Board of Health.

4. All sheep affected with scab or which show any inflamed condition of the skin, and all sheep that have associated in the same flock with such sheep, must be included in the preliminary quarantine.

5. Quarantine must be continued until satisfactory evidence is presented to the State Board of Health that the quarantined animals are not affected with sheep scab; or until the entire flock has been dipped two or more times with intervals of eight days, using a recognized dip according to instructions. (See "Circular of Information Concerning Sheep Scab.")

6. Enclosures wherein sheep affected with scab have been confined must be continued in quarantine for a period of at least eight weeks after such diseased sheep have been removed.

Violation of Quarantine Defined.—It shall be deemed a violation of quarantine for any person to knowingly remove, authorize or cause to be removed any sheep that have been quarantined on account of any contagious or infectious disease, from any farm or enclosure where they have been quarantined, except as provided in rule five (5).

It shall be deemed a violation of quarantine for any person to knowingly cause, authorize, or permit to be placed any sheep, except those already quarantined, in any stable or enclosure that is under quarantine on account of any contagious or infectious disease of sheep.

Many of the large sheep feeders maintain a dipping vat. This is true of the St. Paul Union Stock Yards at South St. Paul.

Sheep scab was reported as follows:

County.	1901. Locality.	1902. Locality.
Blue Earth	Vernon Centre.	Lake Crystal.
Chippewa	Montevideo.	....
Cottonwood	Mountain Lake.	Windom.
Dakota	South St. Paul.	South St. Paul.
Fillmore	Spring Valley.	Harmony.
Freeborn	Albert Lea.	....
Grant		Wendell.
Jackson		Heron Lake.
Lac qui Parle		Lake Side.
McLeod		Hutchinson.
Martin	Conger.	....

County.	1901. Locality.	1902. Locality.
Mower		Austin.
"		Le Roy.
"		Iona Lake.
Murray		Fulda.
"		Chandler.
"		Avoca.
"		
Nobles	Adrian.	
"	Dundee.	
Olmsted	Eyota.	Horton.
"		Horton.
Pipestone		Jasper.
Redwood	Redwood Falls.	
Renville		Buffalo Lake.
Rock	Hills.	Ash Creek.
Steele	Blooming Prairie.	
Traverse	Brown's Valley.	
Wabasha	Plainview.	
Waseca		New Richland.
"		New Richland.
Washington	Newport.	
Watonwan		St. James.
"		Madelia.
Winona	Winona.	Winona.
Wright		Montrose.
Yellow Medicine	Canby.	

The disease was investigated upon complaint or request as follows:

Date. 1901.	Inspector.	County.	Locality.
Feb. 14.	Dr. Brimhall	Olmsted	Dover Twp.
Feb. 15.	Dr. Brimhall	Wabasha	Oakwood Twp.
May 17.	Dr. Brimhall	Nobles	Near Worthington.
Nov. 6.	Dr. Annand	Fillmore	Bloomfield Twp.
Nov. 8.	Dr. Annand	Olmsted	Eyota Twp.
1902.			
Jan. 29.	Dr. Brimhall	Lac qui Parle	Lakeside Twp.
Jan. 30.	Dr. Brimhall	Lac qui Parle	Lakeside Twp.
Jan. 31.	Dr. Brimhall	Lac qui Parle	Lakeside Twp.
Feb. 21.	Dr. Brimhall	Wright	Fridley Twp.
Sept. 24.	Dr. Annand	Fillmore	Harmony.
Sept. 26.	Dr. Annand	Grant	Wendell.
Nov. 13.	Dr. Annand	Murray	Fenton Twp.
Nov. 14.	Dr. Annand	Cottonwood	Windom.
Dec. 10.	Dr. Annand	Marshall	Near Warren.

Date. 1901.	Inspector.	County.	Locality.
Jan. 21.	Dr. Annand	Watonwan	Madelia.
Jan. 22.	Dr. Annand	Watonwan	Madelia Twp.
Jan. 22.	Dr. Annand	Watonwan	St. James.
Jan. 22.	Dr. Annand	Watonwan	St. James Twp.
Jan. 23.	Dr. Annand	Murray	Avoca.
Jan. 23.	Dr. Annand	Murray	Chandler.
Jan. 23.	Dr. Annand	Renville	Morton.
Jan. 29.	Dr. Annand	Murray	Slayton.
Jan. 29.	Dr. Annand	Murray	Slayton.
Jan. 29.	Dr. Annand	Murray	Lime Creek.
Jan. 29.	Dr. Annand	Murray	Lime Creek.
Jan. 29.	Dr. Annand	Murray	Lime Creek.
Feb. 18.	Dr. Annand	Blue Earth	Lake Crystal.
Feb. 19.	Dr. Annand	Watonwan	Riverdale Twp.
Feb. 20.	Dr. Annand	Murray	Iona Twp.
Feb. 21.	Dr. Annand	Watonwan	St. James Twp.

SUNDRY DISEASES OF SHEEP.

Obscure diseases—*Bird Island, Renville Co.*—March 23, 1901, Dr. Brimhall visited the farm of Mr. E. I. W., near Bird Island, Renville Co., Minn., to investigate an outbreak of disease among Mr. W.'s sheep. There were 306 sheep on the place the first part of January 1901. Of these 73 had died up to the time of Dr. Brimhall's visit. Autopsies were made on five and tissues from three of the fresh cases taken to the laboratory. At autopsy there were found no inflammatory lesions, but some very slight hæmorrhagic lesions in all of the sheep examined. These in connection with the symptoms described were sufficient to warrant the suspicion of *hæmorrhagic septicæmia.*

The specimens were received in the laboratory March 24. Direct coverslip preparations, plain broth and serum cultures were made from sheep No. 1. Direct coverslip preparations stained with eosin and methylene blue, from sheep No. 1, showed various large and small bacilli. In the specimens from sheep Nos. 1 and 2, stained with eosin and methylene blue, no bacteria were found.

Cultures.—Cultures from all the organs of sheep No. 1 developed *B. coli communis* and in addition, those from the lung, staphylocccci. Cultures from sheep No. 2 and No. 3 all remained sterile after 72 hours in the incubator, excepting as follows: From the lung of sheep No. 2 were obtained large staphylococci; from the contents of the peritoneal cyst of sheep No. 3 were obtained staphylococci.

Summary.—The bacteriological examination reveals nothing as to the cause of the disease.

Lymphadenitis—*South St. Paul Stock Yards.*—April 1, 1902, Drs. Brimhall, Beckman and Wilson visited the South St. Paul Stock Yards and made examinations of a number of sheep which were affected with a peculiar ulcerative condition of the corners of the mouth and tongue. Two of the sheep were killed and autopsies made. Abscesses were found in the lymphatic glands in the cervical region, in the mediastinum and in the retro-peritoneal region. Aside from these and the ulcers about the mouth there were no gross lesions. Cultures were taken from the various abscesses of glands and from the ulcers about the mouth and from the heart's blood of both animals.

From the ulcers, staphylococci, diplococci and small, colon-like bacilli were obtained.

A very minute, non-motile bacillus, resembling in some respects, members of the *hemorrhagic septicæmia* group, was obtained from abscesses on the lip and in the lung and from the heart's blood of one sheep. This organism was inoculated into rabbits with negative results.

The observations were too few and not of sufficiently positive character to permit the drawing of any conclusions therefrom.

Rabbits Nos. 448-49 were inoculated from the gray rabbit noted above. These died after eight and 21 days respectively, having shown symptoms of rabies, thus confirming Dr. Price's diagnosis.

Obscure diseases—*Long Lake, Hennepin Co.*—April 7, 1903, Mr. D. of Minneapolis, telephoned to the laboratory relative to the occurrence of the above disease among newly born lambs on his farm at Long Lake, Minn. Out of 17 lambs from 10 ewes only five survived. The lambs were either born dead or expired immediately after birth. Dr. Brimhall was notified and requested Mr. D. to send specimens to the laboratory.

April 8, two lambs were received at the laboratory by messenger. One of these had been born at noon of April 6th and the other on the morning of April 8th. They had both died shortly after birth. Post-mortem examination was made by Drs. Brimhall and Wilson in the laboratory. No gross lesions were found in either of the animals except very much enlarged thyroid glands.

Direct coverslip preparations from the thyroid glands of each sheep stained with eosin and methylene blue showed a few nucleated red blood cells and many large hyaline cells (*leucocytes*), but no bacteria.

Cultures on serum and in broth gave no growth after 24 hours in the incubator. Pieces of tissue were preserved in 96 per cent alcohol and in 10 per cent formalin for future histological study.

MEAT, MILK AND CHEESE EXAMINATIONS.

Pork—*New Ulm.*—March 18, 1901, there were received in the laboratory, four samples of pork, accompanied by the following letter:

New Ulm, Minn., March 18, 1901.

Minnesota State Board of Health, Minneapolis, Minn.

Gentlemen: Send you by to-day's express four samples of pork, which I would kindly ask you to inspect and report at your earliest convenience, whether the hog of which this pork is, was diseased, if so, whether it was hog cholera.

The hog in question, I sold alive to a party, and after killing it he refused to pay for it, saying it was affected with hog cholera, and I made the agreement that if this were the case, he should not pay for it.

Have numbered the pieces so you may know from which part of the hog they are.

No. 1, is a piece of fat from over the shoulder. As you will notice there is a cavity about in the middle of the fat which, however, might have been nothing but an ulcer.

No. 2 is a piece of ham meat from the shoulder.

No. 3 is a piece of the tenderloin, with a little piece of the kidney in it, and

No. 4 is a piece of tissue which is grown to the ribs near the lungs. Hoping that this explanation will be satisfactory, and awaiting an early reply, I am,

Yours respectfully,

C. S.

To this the following reply was made:

March 18, 1901.

C. S., New Ulm, Minn.

Dear Sir: Your letter dated the 18th of March, was received this morning. The specimens of a slaughtered hog which you mentioned therein, have just been received this afternoon. The question raised by you and which you ask us to settle is a purely medico-legal one and quite outside the scope of the State Board of Health laboratory. There is no state meat inspection.

As I understand the case, it is purely a business question, as to whether remuneration shall be made for one hog, and there is no question of the existence of an epidemic, or a number of cases of infectious or contagious diseases among animals, at issue. If I am misinformed in this matter and there is existing amongst yours, or other animals in that neighborhood, a contagious or infectious disease, I would suggest that you write to Dr. Bracken, Secretary of the State Board of Health, at St. Paul, Minn. Should the circumstances seem to warrant it, I am sure the veterinary department of the board would take up the question of investigating the disease amongst the hogs. Pending instructions from you as to the disposal of the material, we shall keep it for the next two or three days, in our cooler.

I might add that the likelihood of demonstrating the presence of the microbe of hog cholera, even had the animal suffered from the disease, would be extremely small in specimens collected and sent as these were. The expenditure in time and materials would also probably amount to several times the value of the hog.

Very truly yours,

F. F. WESBROOK.

Director.

March 21, 1901, Mr. R., of New Ulm, telephoned Dr. Wesbrook at the laboratory stating that he had seen Mr. S. the day before and that Mr. S.'s desire was to know whether the meat was fit for sale. That the original letter was written by his son and was worded as it was through a desire to admit that the meat had been killed for food purposes. Mr. R. was told that such an examination would cost the state in time, material, etc., several times the value of the hog. He said he appreciated the situation, and that he would write Mr. S. that it did not seem necessary to spend so much when so little was at stake. Growing out of this promise of Mr. R. to write to Mr. S., the following letter was received:

New Ulm, Minn., March 27, 1901.

F. F. Wesbrook, M. D., Minneapolis, Minn.

Dear Sir: Having had a conservation with Mr. C. L. R., who a few days ago interviewed you in regard to the meat I shipped you, and after having him explain to me what time and labor it would require to ascertain the desired result, we concluded to drop the matter, there being a dispute over one animal only.

Thanking you for your information and time you have given me in this matter, I am,

Respectfully yours,

C. S.

Beef—*Hastings.*—On March 23, 1901, there was received in the laboratory by U. S. Ex. Co., a package accompanied by the following letter:

Hastings, Minn., March 22, 1901.

Dear Dr. Wesbrook: You will receive by express a specimen of beef upon which you will kindly express an opinion.

A certain butcher killed a beef and sold the hind quarter to a Mr. K., who requested me to have it examined. The meat, although killed not over twelve hours, had a blackish appearance. Furthermore, it is known that a heifer died and was sold to the same butcher for the hide. Mr. K. fears that the butcher may have sold him a part of the heifer that died, and hence does not feel at liberty to use the meat unless satisfied that it is fit food.

All the specimens I can get is a piece of adductor muscles of thigh and a kidney. Neither can I state what caused the death of the heifer.

Respectfully,

H. VAN BEECK.

P. S. I do not know whether or not you are the proper person to send the specimen to. If not, will you please forward it, at my expense, to its proper destination.

The package contained a kidney and a piece of muscle. Further than the bluish or purplish appearance of the kidney mentioned in the letter, microscopically there was nothing apparently wrong. Cultures were made from the kidney, the outside of which was sterilized by means of heat immediately after its receipt. These showed no development of bacteria. Even had they done so, it would not have shown that the meat was necessarily unfit for food, in consideration of the fact that the specimens had been in transit for some hours without any means of preventing the development of bacteria which might have gained access to them. It was possible that the purplish appearance of the meat, which was not conspicuous in the part received in the laboratory and may have disappeared owing to free access of oxygen, was due to the fact that the animal was not bled or that it may have been asphyxiated. The small portion of meat was too small, in consideration of its method of sending, to be worth while investigating from a bacteriological standpoint.

Meat—*Green Isle.*—March 31, 1902, there was received in the laboratory a specimen of meat accompanied by the following letter:

March 30, 1902.

Dear Sirs: Herewith, you will please find what I believe to be diseased meat. If it is customary for the State Board to report on such specimens, I would like to hear from you in reference to this. A few hours after taking a meal at which this meat was used, a whole family was taken down with what I diagnosed ptomaine poisoning.

There was violent vomiting and purging, rapid and weak pulse and elevation of temperature. The temperature ranged from 100 to 103. This happened on the 28th inst. and they are all in a very poor condition at this writing. I could attribute their trouble to nothing else than eating this meat. This trouble happened in the township of Young America, Carver county, of which township W. B. is health officer. If you make a report you will do me a favor by sending the report to me, as the health officer does not live in this village.

J. J. LANGFORD, M. D.

Nearly the whole portion of the meat was fed to an animal in order to determine first of all whether it was poisonous or not. The remaining portion was used for making cultures which gave negative results. A large portion of the meat was incubated in broth for 48 hours. The culture was first filtered and the filtrate used for inoculating intraperitoneally guinea pig No. 523, weight 205 grammes, on the 26th of April, 1902. Four days later, April

30th, the animal was dead. The rectum was prolapsed. There was no increase in the amount of peritoneal fluid. The spleen was slightly swollen and congested. The liver was slightly swollen, but of normal color. Kidneys were congested. The bladder was distended. The gall bladder was enormously distended.

Direct coverslip preparations from the peritoneal fluid, liver and gall bladder, stained with eosin and methylene blue, showed no micro-organisms. Cultures in broth and on serum from the same localities remained sterile after 48 hours' incubation. There seemed to be no evidence obtainable by laboratory methods that the meat had been responsible for the symptoms in the people who had eaten it.

Ham and Cheese—*Arlington.*—April 26, 1902, there was received in the laboratory specimens of ham and cheese from Arlington, Minn., accompanied by the following letter:

Arlington, Minn., April 24, 1902.

Dr. F. F. Wesbrook, Minneapolis, Minn.

Dear Doctor: I have cases here in the village that I suspect to be results of some kind of food intoxication. About a week ago, two children of one family, five and eight years respectively, took sick suddenly with vomiting—fever, 102-103, pulse, 120-140. Abdominal pain and purging. The stools consist of mucous particles, blood and fluid. These two children are gradually improving. Day before yesterday the older boy took sick, exactly the same way. His age is 12 years, and to-day the oldest girl, age 14. Now all the children in this family are sick with the trouble. I diagnosed it gastro-enteritis and believe it to be of toxic origin. I have investigated the food they have been eating, and I found this ham. They have been eating from it raw. Also the cheese. Please examine the same, and let me know as soon as possible. The ham was sent in here from some packing house.

Yours fraternally,
C. W. KANNE.

The cheese and meat were both in the same package and in contact with each other in such a manner as to readily permit the contamination of one by the other. Portions of the cheese were fed to mice and they ate it greedily without the production of any symptoms. Cultures were made from both the meat and cheese and after 48 hours in the incubator an exceedingly abundant growth of a motile bacillus was present, apparently unmixed with other micro-organisms. This was morphologically and culturally *B. coli communis.* Cultures from both sources, *i. e.,* cheese and meat were inoculated intraperitoneally into guinea pigs Nos. 524-525 respectively, which died in less than 18 hours. The organism was recovered in pure culture and the previous diagnosis of *B. coli communis* was corroborated.

In order to determine the presence of a toxine in the original material, an aqueous extract was made from the meat and another from the cheese. These were filtered through a Berkfeld filter in order to remove the bacteria, and the filtrate was inoculated intraperitoneally in 1 c. c. doses into guinea pigs Nos. 526-527 respectively. These animals showed no symptoms during the ensuing month, and were thereafter used for another purpose. There was thus no evidence of the presence of any considerable amount of ptomaine present in the original material. It is possible that the strain of *B. coli communis* found in both specimens may have been virulent to man and may have been responsible for the symptoms.

Pork—*Le Roy.*—Jan. 2, 1903, there was received from Dr. M. J. Hart, of Le Roy, Minn., a specimen of pork for examination. Specimen consisted of a portion of the spinal column about five inches long, apparently from the lumbar region, with the attached dorsal muscles and skin. One mass of muscles extending through the specimen was necrotic and a large part of this space was filled with cheesey pus. Direct coverslip preparations and cultures in broth on agar and serum all showed only streptococci.

Lard—*Hawley, Minn.*—Feb. 2, 1903, there was received in the laboratory some small pieces of lard and muscle contained in one of the laboratory diphtheria test tubes. February 3rd, the following letter was received concerning the specimens:

Hawley, Minn., Feb. 2, 1903.

Dr. Wesbrook, University of Minnesota, Minneapolis, Minn.

Find specimens (lard and muscle) which we would like to have examined in regard to whether the hog was diseased or not. We are acting on advice of local board of health and a veterinarian. Report by mail results.

D. & A.

The pieces of meat received were not large enough to make a satisfactory examination. The matter was explained to D. & A. with a request for further data and larger specimens. Nothing further was heard from them.

Pasteurized Milk—Aug. 11, 1902, at 5 p. m., there was brought to the laboratory by the secretary of the State Board of Health, one glass jar of Pastuerized milk which had been bought in the market in St. Paul.

Two gelatin plates were sown with 0.002 c. c. each and two with 0.1 c. c. each of the milk from this jar. The latter two plates showed growth entirely too thick to count the colonies, and the gelatin was liquefied after 60 hours at 21° C. The former plates (sown with 0.002 c. c.), gave 990,500 and 835,000 colonies respectively. An average of these two gave 912,750 colonies per c. c. It is worthy of note that the neck of the milk specimen bottle was slightly chipped and a space left between the paper cap and the neck.

Aug. 19, 1902, another bottle of Pasteurized milk was brought to the laboratory by the Secretary of the State Board of Health. This bottle of milk had been purchased in open market in St. Paul.

Gelatin plates containing 1 c. c., 0.05 c. c. and 0.02 c. c. of the milk were sown. These plates were kept in the culture closet for 48 hours and then counted. The average showed 19,120 colonies per c. c. of the milk.

Bitter Milk—*Long Prairie, Todd Co.*—Feb. 5, 1903, Dr. Annand visited the place of Mr. R. A. L., of Long Prairie, Todd Co., and collected specimens of milk from a cow belonging to Mr. R. A. L. Mr. L. in a letter requested the examination of the milk and said concerning it: "The milk has been used all the time in my family, but in small quantities. We use the cream in coffee and on breakfast foods and use little of the milk. The milk does not taste bad until after it has stood a day or a day and a half. We therefore have used little of it and thrown the rest away. I do not think it has affected any of the family. There seems to be something wrong with the cow, and I think best that the milk be examined in order that I may know that it is not harmful."

Dr. Annand's notes were as follows:

"This cow was giving bitter milk and the owner wished to obtain the reason for it. She was a Jersey cow nine years old. Present owner has had her about two years. The bitterness of the milk was first noticed about 18 months ago, and four months before calving. The animal was dried up and the calf was dropped in November. The milk was all right until the following February. It was not noticed to be bitter until April. The cow was then turned into grass, but the milk remained bitter until the middle of May. The owner then dried the cow up. She calved again about the 20th of October, 1902. The bitterness began about December 1st and was still present when the specimens were taken, Feb. 5, 1903. Cow came from Iowa three years ago. She had been fed good wild hay, bran and peelings. She was in apparently good health. The surroundings were good. The milk was kept in the pantry in winter and in the cellar in the summer, with good surroundings. Mr. W. E. L., father of Mr. R. A. L., took some of the milk from this cow to his place in May and June, 1902, and kept it in the refrigerator. The milk was still very bitter there. The bitterness seemed to vary at times. The animal had salt in her manger, and in January had been given one pound of Epsom salts and had the dose repeated on the second day with no apparent change in the milk.

I took a milking from this cow after preparing her in the following manner:—The cow's udder and teats were sterilized by being washed with a 1.1000 bichloride solution. The udder was then covered with a piece of gauze sterilized in bichloride solution and having four holes cut for the teats to project through. My hands were then sterilized, and into sterilized bottle No. 1 a portion of the first milk from all four teats was milked; into sterilized bottle No. 2 specimens of the second milk from all four teats were collected; into sterilized bottle No. 3 the last milkings of all four teats were collected. Into sterilized bottle No. 4 was placed a specimen of milk (from an earthen crock) which had been milked the day previously by Mr. L. The specimens were collected on the morning of February 5th and brought to the laboratory at 5 p. m. of the same day."

Bottles Nos. 1-2-3 and 4 noted in the above report by Dr. Annand, when received in the laboratory at 5 p. m., Feb. 5, 1903, were placed immediately in the ice chest and the following morning plates of agar were made by using 1 c. c. and .01 c. c. of milk from each bottle.

Cultures were made from each bottle by placing 1 c. c. of milk into a tube of broth. This was shaken up and sown into a second tube of broth with a large loop, and streakings were made onto serum and agar from this second dilute broth. At this time the milk in bottle No. 4 had a penetrating bitter taste. The milk from bottles Nos. 1-2-3 was sweet.

The milk in bottle No. 2 was divided into three parts. The first part was placed in a sterile flask and placed in the ice chest. This milk remained sweet for nine days and no peculiar taste was noticed at any time. The second portion was shaken up with an excess of chloroform. The third portion was steamed in the autoclave for 10 minutes.

Cultures from bottle No. 2 showed a white staphylococcus.

Cultures from bottle No. 3 showed a white and a yellow staphylococcus.

Cultures from bottle No. 4 showed a white staphylococcus and an evenly staining, rod-shaped, non-motile bacillus, which formed a thick ropy mass in broth, but no pellicle. Did not coagulate nor redden litmus milk. Plain milk was not made bitter by the growth in it of the organism. Formed a white moist growth with very slight reddening on litmus dextrose, saccharose and maltose agars. Formed the same white moist growth on lactose agar, but decolorized the agar. Formed white moist colonies on serum.

It is apparent from the above that the bitterness was not in the milk when drawn from the cow, but that it was produced by the growth of some organism which got in from outside, either from the air or the receptacles.

Milk—*Herman, Grant Co.*—Feb. 14, 1903, there was received in the laboratory through the Secretary of the State Board of Health, a specimen of milk accompanied by the following letter:

Dear Sir: Have to-day sent you by mail, a four-ounce bottle of milk. Please report the condition of same as soon as possible, and oblige,

E. E. H.

A second letter from Mr. H., dated February 16th, says: "I want this milk examined regarding poison or other affects that might be in said milk, and not from a sanitary point. The milk in question has a peculiar taste." A third letter received from Mr. H., February 19th, said: "The taste of the milk I cannot describe, only it is a taste that is not right. I felt no evil effects after drinking the milk, but never took over a few swallows. The cream seems to be all right when in coffee or used otherwise. The surroundings where the cow is kept could not be better." It was suggested to Mr. H. that the development of the taste might be only a temporary matter, possibly related to the manner of storing the milk or probably a slight oversight on the part of the person whose duty it was to thoroughly cleanse the receptacles in which it was contained. He was requested, in case the change in taste continued and the matter became serious, to communicate with the Department with the idea that some one might be sent to make an examination of the milk. No further communication has, however, been received from Mr. H.

Milk—*Mountain Lake, Cottonwood Co.*—April 9, 1903, there was brought to the laboratory by Dr. Brimhall, a pint beer bottle filled with milk which had been collected on April 5th on the farm of Mr. S., near Mountain Lake, Minn.

This milk had been collected by Mr. S. without aseptic precautions, and brought in for examination to determine, if possible, the cause of the bitter taste in it.

One c. c. of this milk was taken with a pipette and sowed into broth, and from the broth streakings were made onto agar and serum.

Cultures showed a streptococcus, a large white staphylococcus, a small rod-shaped bacillus which coagulated and decolorized litmus milk and grows with an abundant orange yellow growth upon all solid media. Also a very small motile bacillus which forms a heavy pellicle in broth, which later sinks to the bottom of the tube; a moist growth on serum, which is of the same color as the serum; a moist growth upon all litmus agars, which are slightly alkalinized; does not coagulate litmus milk and alkalinizes it slightly; does not form indol. This bacillus is not identical with the bacillus found in the bitter milk obtained on the farm of Mr. L., Long Prairie, Minn.

* * * * * * * *

The most obvious lesson to be drawn from the above account of these sundry examinations of meat, milk, etc., is the necessity for the proper selection, collection and transmission of specimens. Many of the specimens above described were absolutely useless for the purpose for which they were sent, because they came from the wrong source. Most of them were improperly collected and improperly packed for shipment. Not infrequently very much more time is wasted in the laboratory in attempting to determine something from erroneously collected and shipped material than would be required to send a man to the locality to investigate and collect specimens in the proper manner.

DIPHTHERIA (?) IN CAT.

St. Paul, Minn.—Sept. 6, 1901, there was received from Dr. Richard Price, St. Paul, a specimen consisting of a culture on serum with the swab with which it was taken from the tongue of the cat, the property of Dr. K. B., St. Paul. Specimen had been taken August 31st, but was brought to the laboratory by Dr. Price September 6th. A heavy, pasty growth already existed on the serum which was partially liquefied. Fresh cultures were sown from the swab and from the serum in broth and on fresh serum.

After 24 hours in the incubator, a heavy growth in all of the cultures appeared. A mixture of bacteria consisting of staphylococci, very short colon-like bacilli and large spore-bearing bacilli were present on microscopic examination. After 48 hours in the incubator, the serum in all the tubes was beginning to be liquefied. Since the culture had been six days collected before it was placed in the incubator, and since such a large admixture of bacteria was present without any forms resembling *B. diphtheriæ*, no further sub-cultures or study of the micro-organisms was made.

RABIES.

Introductory.—Up to Jan. 1, 1901, specimens from 51 supposedly rabid animals had been received and examined in the laboratory. These have all been reported in the reports of this board for 1895-98 and 1899-1900. An analytical report of the first twenty cases was presented at the American Public Health Association, Oct. 29, 1897. Further notes on these twenty cases and the succeeding twenty-six cases were also published in the St. Paul Medical Journal, August, 1900.

In addition to the above reported cases occurring prior to 1901, on Dec. 11, 1901, the following information concerning another large outbreak was received:

Outbreak 39A—*Fridley, Anoka Co.* (*Cattle*).—March 12, 1900. A number of cattle in a herd of 140 belonging to Mr. L. H. Hoyt were bitten by a strange dog. Between two and three weeks afterward the cattle began to develop symptoms of rabies and *sixty-five* died or were killed during the ensuing six months.

From Jan. 1, 1901, up to the present date, May 1, 1903, specimens have been examined in the laboratory from 41 cases of supposed rabies.

The following contains a detailed report of these cases and information concerning certain others:

Outbreak 45—*St. Paul, Ramsey Co.* (*Dog*)—*Lab. No.* 52.—Jan. 18, 1901, Dr. Richard Price of St. Paul, sent to the laboratory a small pug dog which was in the paralytic stage of rabies. This animal was a case which had occurred near Olive street in St. Paul. It was exhibited to the class in pathology and bacteriology in the Medical Department of the University. On the morning of January 19th the dog was found dead. Rabbits 416-417 were inoculated therefrom and died in 20 and 16 days respectively after exhibiting symptoms of rabies.

March 1, 1901, information was received from Dr. Price that two other dogs, the property of Mrs. C., St. Paul, had been bitten by the above mentioned dog and were, at that time, showing symptoms of rabies. One of these, a terrier, had shown symptoms about the middle of February and disappeared permanently. The second, a setter, was shot when symptoms were well developed.

Outbreak 46—*Faribault, Rice Co.* (*Swine*)—*Lab. No.* 53.—Feb. 28, 1901, there was received in the laboratory from Dr. L. Hay, of Faribault, Minn., the head of a hog, accompanied by the following letter:

> I send you this day, per U. S. Express, a specimen of a hog's head which was shot by its owner because of suspected rabies. The history of the case is as follows:
>
> "About three weeks ago, some unknown animal, wolf or dog judging from the tracks in the snow, visited the yard belonging to Mr. A. C., and killed a number of chickens without carrying any away. Last Friday night the owner noticed that one of his hogs commenced to exhibit all the symptoms of rabies. Saturday morning he was getting worse, confirming the diagnosis of rabies. He was shot by the owner in the forenoon of the same day after having inflicted wounds on every hog in the pen."
>
> L. HAY.

Two series of rabbits were inoculated with material from this case, Nos. 418-19 and 422-23, and died after exhibiting symptoms of rabies.

Under date of March 28, 1901, Dr. Hay gave the further information that Mr. A. C. had one other hog which had been destroyed after exhibiting symptoms similar to those exhibited by the one noted above.

Outbreak 47 (?)—*St. Anthony Park, Ramsey Co.* (*Dog*)—*Lab. No.* 54.—Feb. 28, 1901, there was received in the laboratory from Dr. M. H. Reynolds, of the State Experiment Station, St. Anthony Park, Minn., the head of a dog, accompanied by the following history:

"The animal had been bitten 10 days previously by a strange dog. Feb. 27th he was first seen by Dr. Reynolds and then seemed to be paralyzed. He died Feb. 28th, and the head was removed and sent to the laboratory."

Cultures from the medulla showed encapsulated, Gram-staining diplococci and short bacilli. Rabbits Nos. 420-21 were inoculated from the material and died in four days after exhibiting symptoms of meningitis. At autopsy, diplococcus pneumoniæ (?) was found in direct coverslip preparations and cultures.

Outbreak 48—*Iona, Murray Co.* (*Dog*)—*Lab. No.* 55.—April 15, 1901, there was received in the laboratory a dog's head from Dr. L. A. Williams, of Iona Lake, Minn., accompanied by the following letter:

> March 25, a strange dog came to the house, looked wild and ran around biting at everything. It bit two other dogs, several head of cattle and some swine. This dog was killed April 7th. The jaw of dog designated No. 1

was found bitten and swollen. The animal could not close its mouth, and tried to bite and eat but could not. It was tied up and continued restless until April 10th, when it died. April 8th, dog designated No. 2, four months old, was noticed acting unnatural and cross. It bit the other dogs. It ran away April 9th and came back April 10th. April 10th it was lying on the floor when a man dropped a handkerchief a few feet from him. The dog jumped at him, lacerating three small places on the back of the hand so that blood flowed. The dog was tied up. April 11th it acted cross and would attempt to bite anyone that went near him. Would also bite at a stick. Continued to eat until the afternoon of April 12th; then refused food; became more quiet and was found dead, but still warm, on the morning of April 13th. What would be your advice to patient in regard to going to the Pasteur Institute?

L. A. WILLIAMS, M. D.

Advice was given to send the patient to a Pasteur Institute without awaiting a laboratory report. Two series of rabbits were inoculated, Nos. 425-26 and Nos. 428-39. These all died in periods of from 15 to 30 days after exhibiting symptoms of rabies.

Outbreak 49—*Minneapolis, Hennepin Co.* (*Man*)—*Lab. No.* 56.—May 7, 1901, Dr. Wilson collected specimens from a case of rabies occurring in the practice of Dr. R. A. Campbell, Minneapolis, Minn. The case gave the following history:

Saturday, April 20th, F. H., nine years of age, was playing in his father's yard in South Minneapolis, when a strange dog ran into the yard, attacked and bit him at the base of the right thumb nail and over the metacarpo-phalangeal joint of the forefinger of the right hand. The wounds were but slight ones. They were washed with water into which a small amount of carbolic acid had been placed, healed rapidly and the incident was almost forgotten. The dog was not seen again by anyone in the neighborhood.

Saturday evening, May 4th, two weeks after the bite, the child was excited, slightly feverish and drank a great deal of water. By the following (Sunday) morning, he appeared to have some difficulty in swallowing. Dr. Campbell was called about noon Sunday. He found the child with slightly increased temperature, but apparently well and rational, except a constant desire to drink and an inability to do so on account of spasm or slight convulsion when attempting to swallow fluids of any kind. Dr. G. D. Head was called in consultation Monday afternoon, May 6th, and found the same symptoms, but somewhat exaggerated, the child going into a marked spasm whenever it attempted to drink. He was still perfectly rational and objected to trying to drink fluids, because, as he said, "it made him want to lie down." (He had not been talked with by any one, except at the time of the bite, concerning the bite and, presumably, knew nothing of the symptoms of rabies). Spasms were readily excited Monday evening whenever anyone entered the room. They grew rapidly worse during the night, and the child died about 2 a. m., May 7th. About 2:30 a. m., i. e., about 30 minutes after death, the body was injected with over one and one-half pints of 15 per cent formalin, that is, 6 per cent formaldehyde solution, by an undertaker. The undertaker said that at the time he made the injection the body was in the most intense rigor mortis. He succeeded in getting a very perfect injection, as was evidenced at autopsy.

Autopsy at 9:30 a. m., May 7th, seven and one-half hours after death. Body was that of a slender, poorly nourished, eight or nine year old, male child. Two slight scars were found; one at the root of the nail of the right thumb and the other over the metacarpophalangeal articulation of the right forefinger. In opening the abdominal cavity, a very strong odor of formaldehyde was present. The liver, stomach and intestines were bleached and hardened by the solution. Otherwise, all the organs were apparently perfectly normal in size and shape. No evidences of inflammation. A slight puckering was present at the apex of the left lung and at the base of the right lung was a small amount of hypostatic congestion. The heart, anteriorly, was markedly affected by the formaldehyde solution. (Undertaker said that he had succeeded in getting a complete circulation of the fluid).

The brain was markedly hardened by the formaldehyde solution, except the posterior temporal lobes, which did not appear to be much affected. (The cranium had been injected by means of a trochar thrust into the fourth ventricle.) The interior of all the ventricles of the brain was well hardened; the medulla and upper cord markedly so. The brain and five or six inches of the upper end of the cord were removed and brought to the laboratory. The base of the skull containing the proximal portions of the cranial nerves was chiseled out and brought to the laboratory. All the specimens were placed in 10 per cent formalin with 33 per cent alcohol, after inoculation material had been selected.

An emulsion was made from the white matter apparently least exposed to formalin in the interior of the posterior temporal region, and rabbits Nos. 426-427 inoculated therewith at 3 p. m., May 7th, 1901. These animals died in eight and seventeen days respectivêly after inoculation, after having exhibited symptoms of rabies. A second series, rabbits Nos. 432-33 were also inoculated and died after exhibiting symptoms of rabies.

This case is of particular interest not only because of its occurring in man, but further because of the fact that the virus of rabies was unchanged by a very thorough embalming by formaldehyde, seven hours before the collection of the specimens.

Outbreak 50 (*?*)—*South St. Paul, Dakota Co.* (*Dog*)—*Lab. No.* 57.—May 17, 1901, at 7 p. m., Dr. Annand brought to Dr. Wilson's house, the head of a dog wrapped in paper, of which he gave the following history:

The dog, on the morning of May 17th, was seen to be acting strangely near the stockyards in South St. Paul. He was shot by a policeman, skinned and thrown into a rendering vat. Sometime in the afternoon, Health Officer C. G. Lytle had the carcass removed from the vat, the head severed from the body, wrapped in paper and given to Dr. Annand to bring to the laboratory. The head was kept in the ice chest until the morning of May 18th, when it was brought to the laboratory and examined. The head was that of a medium-sized dog, probably about 30 to 40 pounds in weight, had been skinned and was much decomposed for so short a time after death (24 hours), possibly due to the action of materials in the rendering vat noted above. A portion of the medulla was removed in as cleanly a manner as possible, an emulsion made and rabbits 430 and 431 inoculated therefrom. These animals were found dead the next morning.

Cultures in broth and on serum from the inoculation material after 24 hours in the incubator showed abundant growth of large, non-motile spore-bearing bacilli, small motile bacilli and staphylococci. Serum liquified. Owing to the decomposed condition of the material it was impossible to make a diagnosis.

Outbreak 51—*Minneapolis, Hennepin Co.* (*Dog*).—May 20, 1901, Dr. Annand examined a dog, the property of Mr. G. O., northeast Minneapolis, and found it exhibiting unmistakable symptoms of rabies. The animal had been bitten by a cur, which was afterwards killed for his strange actions about two months previously. The dog was killed, but no specimens were collected.

Outbreak 52—*St. Paul Park, Dakota Co.* (*Dog*)—*Lab. No.* 58.—June 8, 1901, there was received in the laboratory, from A. H. F., of St. Paul Park, the body of a small puppy which had been killed after exhibiting symptoms of rabies. The puppy had been bitten on May 19th by a dog which also bit several other dogs in the same vicinity. All the bitten dogs were kept tied.

Rabbits Nos. 434-35 were inoculated subdurally with this material and died in 15 and 21 days respectively. A second series, Nos. 444-45 were inoculated from this material and died after 11 and 30 days respectively. The case was diagnosed rabies.

Outbreak 53—*New Canada, Ramsey Co.* (*Dog*).—Aug. 13, 1901, Mr. Pomplun visited the place of Mr. B. K., New Canada Township, Ramsey County, to investigate a case of supposed rabies. He found that a dog, the property of Mr. B. K., had been bitten by a supposedly mad dog about two weeks before. He ordered the dog tied up awaiting developments.

Aug. 17, 1901, Mr. Pomplun again visited Mr. K.'s farm and found that in the interval the dog had become morose, refused food, snapped at everything in reach and had been killed by his owner a few minutes before Mr. Pomplun's arrival.

Minneapolis, Hennepin County (*Horse*)—*Laboratory No.* 59.—Aug. 14, 1901, there was received in the laboratory the head of a mare from Dr. C. C. Lyford. The animal had been exhibiting symptoms of rabies for three days before her death.

Rabbits Nos. 446-47 were inoculated with material from the specimen and died after 19 and 18 days respectively, having shown symptoms of rabies. A second series of rabbits, Nos. 450-51 were inoculated from these and died after 17 and 15 days respectively. The case was diagnosed rabies.

Outbreak 54—*St. Paul, Ramsey Co.* (*Dog*)—*Lab. No.* 60.—Aug. 30, 1901, Mr. C. N., of St. Paul, brought to the laboratory in a basket two rabbits, one small white one dead. The other, a gray rabbit, not dead, but almost so. When removed from the basket the latter rabbit showed faint twitching of the face muscles and very slight twitching of the fore paws; completely paralyzed otherwise; hind limbs were extended and the head retracted. Accompanying the rabbits was the following letter:

> The bearer, Mr. C. N., has two rabbits that I have inoculated from his bull terrier that bit him August 4th and was destroyed in a dying condition August 9th. On August 10th, I inoculated these two rabbits from the cervical spinal cord of the dog. Yesterday, August 29th, the brown rabbit became paralyzed and the white one showed peculiar ungainly hind action especially in the left leg. This morning at 8:30 A. M., the white one died, paralyzed. As some one has told him and his friends that rabies does not exist only in my mind, I have told him to submit them to you as impartial judges and make inoculations to set the matter at rest. Mr. N. has taken the Pasteur treatment and wishes to know if he has done so unnecessarily.
>
> RICHARD PRICE.

Outbreak 55—*State Experiment Station, Ramsey Co.* (*Cow*)—*Lab. No.* 61.—Sept. 27, 1901, there was received in the laboratory at 3 p. m., the head of a cow. Ten minutes later Dr. Lyford telephoned the following history of the case:

Yesterday, September 26th, the cow, a young black Holstein, at the State Experiment Station, which had been running in pasture during the summer with other cattle, began to show symptoms of craziness. She butted at the attendants, other cows, chickens, etc. Considerable escape of fluid from the mouth was present and the animal appeared weak, especially in the fore legs. She was noticed eating unusual articles, such as acorns, rugs, etc. She died about 11 a. m., Sept. 27th, not having been seen by a veterinarian. At 11:30 Dr. Lyford made an autopsy on the body. He found all of the organs normal, the central nervous system not being examined. The stomach contained numerous foreign bodies, such as a snake, several rags, pieces of rug, blanket, acorns, sticks, etc., etc. Some very dark mucous was found in the large intestine. The specimen as received in the laboratory consisted of the skin, head and upper portion of the neck of a cow, several lengths of intestine tied off, containing dark, liquid fæces.

Direct coverslip preparations, cultures in broth and on serum were made from the meninges. A portion of the medulla was used for inoculating rabbits Nos. 454-455. These animals remained alive and well during the ensuing three months, after which time they were used for another purpose.

A diagnosis of rabies was not warranted from the laboratory examination.

Outbreak 56—*Harrison Twp., Kandiyohi Co.* (*Dog*)—*Lab. No.* 62.—Oct. 21, 1901, there was received in the laboratory a brain and a portion of the spinal cord of a dog, accompanied by the following letter:

> I send you by express the brain and cervical portion of the spinal cord of a dog. This dog was suspected of having rabies. The dog was not known to belong to anyone hereabouts. Had never been seen by anyone around here before to my knowledge. He came to the farm of Mr. J. N., in Harrison township, about 1 o'clock, October 20th, and attacked the poultry. As soon as Mrs. N., fho was alone on the farm, went out doors the dog at once attacked her, lacerating her hand severely. The dog persisted in the attack until finally Mrs. N. got hold of an ax and dispatched the dog by a blow on the head. The dog presented evidences of a recent encounter with a skunk. It was a female hunting dog of some kind. I have removed the

specimens, I regret to say, not under the strictest aseptic precautions, but the jar was thoroughly sterilized and the specimens placed in glycerine.

F. M. ARCHIBALD, M. D.

From the specimens rabbits Nos. 458-459 were inoculated and died in 77 and 21 days respectively, having exhibited symptoms of rabies.

Dr. Archibald's letter was answered immediately upon the receipt of the specimens and advice given that the patient be sent to a Pasteur Institute. Under date of October 23rd, he said:

> I thoroughly cauterized the wounds on the lady's hands and cleaned them as well as possible. They are doing very well. She is not at all alarmed about the probability of hydrophobia and I do not think she could be induced to go to Chicago for the Pasteur treatment unless the results of the inoculations are positive. F. M. ARCHIBALD.

From rabbit No. 459, rabbits Nos. 463-64 were inoculated and died after 45 and 25 days respectively. From rabbit No. 463, rabbits Nos. 528-29 were inoculated and died after 22 and 21 days respectively. All of these animals exhibited symptoms of rabies before death. The long period of incubation in rabbit No. 458 may have been due to the fact that the material had been preserved for some time in glycerine before it was inoculated.

Jan. 2, 1902, a statement of the results of the inoculations up to that time was again made to Dr. Archibald. Under date of Jan. 4, 1902, he wrote:

> The wounds on Mrs. N.'s hand healed in the course of a week or ten days and she has had no symptoms since except some numbness in one finger that was injured the worst. She is gradually recovering from that. Doubtless this was due to the injury of a nerve. Mrs. N. is not particularly inclined to borrow any trouble about the matter. I spoke to her and her husband about going to Chicago for the Pasteur treatment, but she did not care to go.

On Feb. 27, 1902, Dr. Archibald was informed of the final result of the laboratory investigation, i. e., that the case was certainly rabies. No further information was received in the laboratory concerning this case.

Outbreak 57—*Taunton, Lyon Co.* (*Steer*)—*Lab. No.* 63.—Oct. 29, 1901, Drs. Brimhall and Wilson visited the farm of Mr. H. P., three-quarters of a mile west of the town of Taunton, Minn., examined, killed and made an autopsy on the body of a steer, the sixth in a herd exhibiting similar symptoms. The following history of the outbreak was obtained:

About September 20th a bitch on the place, which had been apparently sick for two or three days, was noticed to be covered with the odor of skunk. During the day she seemed morose, somewhat cross and was seen to bite a horse and a spring calf. On the evening of the same day she was tied up and shot. The owner thought nothing more of the matter until Friday, October 18th, when a yearling heifer was noticed by the herd boy to be acting crazy. The heifer would run rapidly for a short distance and then drop down upon her belly. After lying a few minutes she would rise and walk about as though nothing had occurred until another "running" spell took her. Occasionally she would stop and bawl furiously.

Twenty-four hours later a two-year-old steer became similarly affected. Both would rush at the owner or any moving object and attempt to butt it with the forehead. The animals occasionally stuck their noses into the dirt and tried to eat it. They seemed to have difficulty in swallowing, especially fluids. The heifer died after three days' illness and the steer was killed at the same time that he might be buried in the same hole. During the week of October 20th to 26th, four more cattle, from calves to three-year-olds, became affected. One of these died after four days' illness, two were killed by the owner and the sixth, which became sick October 26th, was killed by the writers October 29th for purposes of autopsy. When seen by the writers, the animal was in a shed and bawling almost constantly. Occasionally he would make a wild rush across the shed over manger or against posts or walls, as though insane. Usually such a rush ended by the animal dropping to the ground as though shot. A large amount of foamy saliva was dropping from the mouth. The eyes had a wild staring expression. Temperature 103.6°. The animal was killed and an autopsy made at once. No lesions whatever of any of the organs were found except in the central nervous system. Here extra-durally at the base of the cranial cavity and surrounding the pituitary body was found a small, dark red clot. Some injection of the vessels of the pia was present over the entire surface of the brain, especially over the posterior lobes of the cerebrum. A very large amount of fluid, straw colored and clear, was present subdurally and within the ventricles of the brain. Direct coverslip preparations and broth and serum cultures were taken from the lung, spleen, heart's blood, brain substance and serum of ventricles of the brain.

Direct coverslip preparations stained with eosin and methylene blue in the laboratory, showed no bacteria. All cultures remained sterile except one of two serum tubes sown from the brain substance. This showed two colonies slightly yellowish in color and consisting of large bacilli. Two broth tubes from the same place gave no growth. It is probable, therefore, that these two colonies were a contamination, an accident which might readily have happened since the autopsy was made in a shed which had recently been strewn with fresh hay.

A portion of the medulla removed with aseptic precautions was used for inoculating rabbits Nos. 460 and 461. These two rabbits both died after 20 days, having shown symptoms of rabies. From one of them, a second series of rabbits, Nos. 465-66, were inoculated and died after 18 and 17 days respectively, having shown symptoms of rabies.

Under date of Nov. 4, 1901, information was received from Mr. J. that two more cattle had shown symptoms similar to those exhibited by the other animals and that one had died and he had killed the other.

November 25th, Mr. J. lost another cow with the disease. The head of this animal was shipped to the laboratory, where it was received Nov. 27, 1901. It was listed as case No. 66. Rabbits Nos. 474-75 were inoculated with material therefrom and died in 20 and 23 days respectively after exhibiting symptoms of rabies. From one of these a second series of rabbits, Nos. 488-89 were inoculated and died after 35 and 17 days respectively, having exhibited symptoms of rabies before death.

On Nov. 30, 1901, information was received from Mr. J. that some days previously his large, black Newfoundland dog had acted strangely, and in order to avoid trouble the animal was killed immediately.

It will be seen from the above that in this outbreak nine head of cattle and two dogs were affected with rabies.

Outbreak 58—*Bloomington, Hennepin Co.*—*Case No.* 64 (*Dog*). —On the morning of November 21st, Dr. A. A. Keys, V. S. of the Department of Health, Minneapolis, telephoned the laboratory that the carcass of a supposedly rabid dog, which had bitten some people and several animals in Bloomington Township, Hennepin County, had been left at his office through misunderstanding.

On the afternoon of November 21st Dr. Wesbrook visited Bloomington and Richfield and saw Mr. W. A. Harrison, C. B. S., of Bloomington, Minn., J. A. D., of Bloomington, Mr. A. D., a near neighbor of Mr. J. A. D., and the postmasters at Bloomington and Richfield. From these sources and Dr. Keys and from numerous letters, the following information was obtained:

On the afternoon of November 19th, at 4 p. m., a rather large-sized yellowish to brown, stoutly built dog attacked Mr. H. W. P., who lives close to the Minnesota river, about two miles east of Bloomington P. O. The dog approached Mr. P. from behind and inflicted wounds on the outer aspect of the left thigh and punctured the back of the right. His right hand was very badly lacerated, the end of one finger being almost destroyed. (See below—notes of Dr. J. Clark Stewart, Minneapolis.)

A dog answering this description was next seen at 5 p. m. of the same day by E. R. P. and J. B. on Lyndale avenue, about midway between Richfield and Bloomington, where it attacked dogs belonging to Mr. S., Mr. F. B. and P. C., and acted in a peculiar way in other regards. At 8:30 the same evening, after dark, a large dog, from description apparently the same one, appeared at the house of Mr. A. D. Something worrying the house dog and making a noise over his food pan attracted the attention of Mr. D.'s son, F., aged 17, who, in going out to drive away, as he supposed, a neighbor's dog, was attacked, thrown down and very severely bitten in the left leg and the left thumb. (See below—notes of Dr. J. H. Stuart, Minneapolis.)

Fifteen minutes later, as Miss M. L. D. stepped from the door of her father's (J. I. D.'s) house, she was set upon, knocked down and very severely bitten on the left thigh. (See below—notes of Dr. J. A. Crosby, Minneapolis.)

The next morning about 9 o'clock the dog was first seen by school children west of Mr. R. M. B.'s house (P. O. address, Bloomington Ferry), which is about five miles west of Mr. D.'s residence. Soon after the dog had been seen by the children, Mrs. B. saw it in the yard with the cattle, where it lay down until approached by the cattle, when it invariably jumped up and chased them. Mrs. B. drove it from the yard, but it chased her into the house. The dog immediately turned upon some little pigs in the door yard and Mrs. B. opened the door and threw the broom at it. The dog caught and chewed the broom. At 10 o'clock this same morning (November 20th) the dog was shot by Mr. S. at Mrs. B.'s request and the carcass was brought to Dr. Keys, V. S., Minneapolis, by J. A. D. of Bloomington, on the morning of November 21st.

Mr. W. A. Harrison, C. B. S., of Bloomington, visited Mr. B. and furnished a portion of the above history. He states that he could not find any of the cattle which showed evidence of having been bitten, nor did Mrs. B. see them bitten. One colt had a scratch on the side of the head.

Route followed by the dog.—November 19th, 4 p. m., seen two miles east of Bloomington (attacked Mr. P.). At 5 p. m., same day, midway between Bloomington and Richfield, i. e., five miles N.E. of Mr. P.'s place, where it bit several dogs and two people before 9 p. m.; 9. a. m., Novmber 20th, five miles west from where it was observed the night before.

List of people and animals bitten by the dog.—*People.*—Mr. H. F. P., Bloomington P. O., November 19th, 4 p. m.; F. D. and Miss M. L. D., between 8:30 and 8:45 p. m., November 19, 1901.

Dogs.—Dogs belonging to Mr. S., Mr. F. B. and Mr. C. and Mr. A. D.

Other animals.—Several small pigs, possibly one colt and perhaps some of the cattle belonging to Mr. R. M. B.

Precautionary Measures and Procedures—*Human Beings.*—Mr. H. F. P. and Miss D. were sent to Dr. Lagorio's Pasteur Institute, Chicago, on the night of November 20th, and F. D. was taken there on the following evening by Dr. J. H. Stuart. Concerning local treatment, nature of wounds, etc., see notes below for information kindly afforded by Drs. J. Clark Stewart, J. H. Stuart and J. A. Crosby.

Animals.—Dr. Wesbrook advised Mr. W. A. Harrison, C. B. S., to see that all dogs and cats which had been bitten be destroyed; that pigs be confined and that horses, cattle and other animals be closely watched for the development of symptoms. In the case of cows, it was suggested that should any develop strange symptoms, the owner's should be warned against using the milk.

Of the four dogs bitten those belonging to Mr. A. D. and Mr. P. C. were killed. All other dogs in the neighborhood were chained up, including the two bitten animals belonging to Mr. S. and Mr. B.

Origin of the supposedly rabid dog.—Nothing further than given in this history can be ascertained. Mr. W. A. Harrison investigated the rumor concerning the possible identity of this animal with a stray dog reported to have been seen in the neighborhood of Bloomington P. O. some days previous to the biting. Mr. Harrison took a good deal of trouble in supplying and verifying information, and promised to forward a complete list of any animals in the neighborhood which developed any symptoms of rabies or any other information which might bear upon this case.

Notes from physicians who attended the bitten people.—In response to letters the following information concerning these cases has been kindly afforded:

"Your note of inquiry regarding Miss D. is just at hand. Her injuries were several deep punctured wounds of both the inner and outer aspect of the thigh just above the knee, as if the dog had grasped the part between his jaws. There was some laceration of the skin in one place. The friends had "sucked" out the wounds before my arrival. My treatment was simply a thorough cleansing with a strong bichloride solution and a dressing of iodoform gauze and cotton held in place with a bandage.

(Signed) J. A. CROSBY."

"Your favor making inquiries concerning the wounds of young D., who was bitten by a dog is before me. His left thumb was pierced and slit in three or four places and the nail was torn off—pretty badly injured. There were a number of tooth marks on his left thigh from region of knee up to middle portion—one on inner aspect short distance above the knee was deep and large as a 'nickel.' A slit in the skin on outer aspect an inch or more long. The rest were less serious, several in number, ranging from scratches and bruises to punctures of the skin. They were all made aseptic with formaldehyde and dressed with iodoform gauze. When redressed in Chicago they were free from pus and healing rapidly. I went with the boy to Chicago, and placed him in the care of Dr. Lagorio of the Pasteur Institute, where the other two were located or were under treatment.

(Signed) J. H. STUART."

"Right third finger was chewed off just at base of nail. On left thigh, four inches above knee to outer side was a 1½-inch long gash down to fascia. On outer side of right thigh were two tooth punctures with a good deal of extravasated blood. Wounds had been washed with carbolic solution 1½ hours before I saw them. I cleaned them thoroughly with two per cent formalin and dressed them with sublimate gauze. We then had no knowledge of dog's condition, but I told Mr. P. to hunt up dog at once and if there was any evidence of rabies to go at once to Pasteur's Institute.

(Signed) J. C. STEWART."

Laboratory Notes.—There was received in the laboratory at 2 p. m., Nov. 21, 1901, the body of a large yellowish to brownish dog, evidently part shepherd (weight approximately 75 pounds), which had been shot through the left eye and through the thorax. Owing to the time which had elapsed since the killing of the dog and the pressure of other work, a complete autopsy was not performed. A portion of the medulla was taken by severing the head from the body through the cervical vertebræ. Two rabbits, No. 467, weight 1,915 grammes, and No. 468, weight 1,540 grammes, were inoculated subdurally with .2 c.c. of an emulsion of the medulla in sterile bouillon. These two rabbits died in 22 and 19 days respectively after showing symptoms of rabies, and a diagnosis of rabies was transmitted to the Chairman of the Board of Supervisors of Bloomington on December 12th.

Confirmation of the laboratory diagnosis by later information relative to animals bitten by the rabid dog on November 19th and 20th.

Further information was obtained during January from Mr. Harrison, C. B. S.

Dogs.—1. A dog belonging to Mr. D., which was not supposed to have been bitten, was kept chained, showed symptoms on December 9th, and was shot on the same day by Mr. R. D., who lives about three miles S.W. of Mr. D.'s. The dog had broken the chain and run away.

2. The dog belonging to Mr. B. showed symptoms of rabies on December 8th, and was shot by him.

3. The dog belonging to Mr. H. K., which he thought had been bitten by Mr. D.'s dog, was shot.

4. A dog, owner unknown, was shot by Mr. O.

Other Animals.—1. A pig died 19 days after having been bitten.

2. Cows, two heifers. The date of the death of one is given as exactly two months after having been bitten. The date of the development of symptoms and the death of the other animals is not given, though the symptoms were noted as having persisted for 48 hours, and at the end of 36 hours paralysis occurred.

3. Horses. One three-year-old colt showed symptoms of rabies after having been bitten and died 20 hours later.

Summary.—A dog shown to have been rabid both by laboratory examination and by the subsequent history of bitten animals, bit three people, none of whom developed symptoms of rabies. They had, however, received immediate local treatment and Pasteur treatment was begun within two or three days after the injury.

2. A number of animals bitten by this dog developed symptoms of rabies. These included two dogs, one pig, two heifers and one colt. A number of other animals were destroyed on suspicion.

3. It would seem that it is unsafe to rely upon the owners of the bitten dogs to see that they are properly secured and kept in confinement. A number of letters were written relative to this mat-

ter and the destruction of the dogs known or suspected to have been bitten was urged. Notwithstanding this, one of the dogs, which was supposed to be securely confined, developed rabies, escaped and was shot three miles from his home.

4. The necessity for vigorous protective measures is well shown by the history of this case.

5. Incidentally, the efficacy of the Pasteur treatment is illustrated.

Outbreak 59—*St. Paul, Ramsey Co.* (*Dog*)—*Lab. No.* 65.—Nov. 26, 1901, Mrs. T., owner of the dog in this case, brought to the laboratory a kidney and the head of a Cocker spaniel. From the brain, Dr. Price of, St. Paul, had already inoculated two rabbits subdurally. These rabbits were also brought to the laboratory. Accompanying the specimen was the following letter:

> The animal is a black Cocker spaniel, five months old. It was bitten by a mongrel cur about three months ago. This dog, a terrier, at the same time killed some cats and developed a snappish disposition. He fought with other dogs in the neighborhood and was killed by the owner on account of his aggressiveness. The Cocker spaniel first began acting strangely in the forenoon of Nov. 14, 1901, by seeking consolation and petting more than usual, so much so as to cause the owner to remark on it. He next chased some chickens, biting the tail feathers off two. Later he crossed the street and killed one chicken after a general attack upon the flock. The lady owning the chickens noticed the dog chasing them and called his mistress. She drove her dog away, but he returned again to the attack of the fowls. Mrs. T. punished him, when he suddenly ran at the lady owning the chickens, jumped at her and attempted to bite her. He was carried home by his mistress and shut in the barn. During this time he either bit or scraped Mrs. T. on the hand between the thumb and first finger. That evening Mr. T. found the dog in the barn acting snappish. Suspecting rabies, he attempted to catch the dog by the collar with a rake. The dog snapped at the implement, and the collar breaking the owner lassoed him until he could slip on a muzzle. The next evening the dog was brought to my infirmary, where he evidenced his snappish disposition. At all times he was silent except when aggravated and attacking an object repeatedly. He made no sound nor evidenced any sign of pain when struck. He ate and drank up to the day previous to his death. He tore his bedding, took the basin containing the drinking water in his mouth, spilled the water and "worried" the basin. He snapped at any object presented to him until the last day, when he appeared indifferent and semi-paralytic. He died November 25th at about noon, that is eleven and one-half days after his first restlessness was noticed. On the whole, the dog showed the usual characteristic symptoms of furious rabies, and the fact of his having been bitten by a supposedly rabid dog strengthens the diagnosis of rabies. The objection to this diagnosis is the long period of nearly twelve days between the onset of symptoms and his death. R. PRICE.

The head of the spaniel when received in the laboratory had had the skull removed (by Dr. Price) and the upper surface of the brain was macerated. Cultures were made from the medulla and direct coverslip preparations were taken from the meninges at the base of the brain. About two inches of the spinal cord was removed with the dura intact. This portion of the cord was used for inoculating rabbits Nos. 472-73. The direct coverslip preparations from the meninges at the base of the brain showed a Gram-staining diplococcus. It was also present in broth cultures from the medulla as well as a staphylococcus.

The two rabbits which had been previously inoculated by Dr. Price were kept in the laboratory and died in 19 and 21 days respectively. At autopsy both rabbits showed congestion of the meninges. Direct coverslip preparations from the meninges, heart's blood, lungs and liver showed no bacteria. Cultures from the same sources showed no bacteria except one culture from the lung of rabbit B, which showed short bacilli. From rabbit A of this series, the second series, rabbits Nos. 482-83 were inoculated. Rabbit No. 482 showed no symptoms during the ensuing three months and was then used for another purpose. Rabbit No. 483 died after 10 days. At autopsy the left pleural cavity was found coated with thick, viscid, yellow pus. Cultures showed staphylococci present.

Rabbits Nos. 472-73 inoculated in the laboratory from the spinal cord of the dog died in 21 and 23 days respectively.

In addition to the above subdural inoculations for rabies, rabbits Nos. 492-493-496 and 530 were inoculated intravenously with various cultures of the bacteria obtained from the rabbits noted above. In none of these were any symptoms produced.

This case is of peculiar interest owing to the prolonged period (eleven and one-half days) which elapsed between the appearance of what seemed to be the initial symptoms of rabies and the death of the animal. Out of six animals inoculated from this material in two series, all of the first series (four) died in the usual time and after exhibiting the usual symptoms of rabies. Of the two rabbits in the second series, one died of empyema at the end of 10 days and the other remained alive. Notwithstanding this unsatisfactory feature of the investigation a diagnosis of rabies must be given in consideration of both clinical and laboratory data.

Outbreak 60—*Anoka, Anoka Co.* (*Cow*)—*Lab. No.* 67.—Dec. 8, 1901, Drs. Brimhall and Wilson visited the farm of Mr. G., eight miles north of Anoka, Minn., and killed and made an autopsy on the body of an animal of which the following is a history:

On the morning of Nov. 16, 1901, a large black and tan shepherd dog, the property of Mr. G., was observed to be acting queerly. He appeared excitable and easily irritated. A little later he began chasing the cows, several of which he was seen to bite. He then attacked the hogs in the pen and bit several of them. A three-year-old child of Mr. G.'s attempted to drive the dog from the house with a club and was aided by his mother. The dog appeared to be perfectly obedient when he was made to hear and made no attempt to bite the people. In the evening when Mr. G. returned home, the dog met him, but gave no evidence of recognizing him, an unusual occurrence. While Mr. G. was unhitching his team, the dog thrust his nose up against Mr. G.'s leg as though attempting to bite him, but seemed unable to do so. During the night the dog disappeared and has not since been heard of.

November 27th, 12 days after the episode of the dog, a cow became sick and died in 48 hours. The animal seemed at first excited, but rapidly became paralyzed in the posterior extremities and died apparently in great agony. From this time until December 8th, that is, 11 days, two yearling calves and four pigs died with symptoms consisting essentially of an initial period of excitement followed by a period of paralysis. The eighth animal, a cow, had been sick for three days when seen December 8th. She appeared excited, attempting to butt chickens, turkeys, etc., when they came near her. A rather thick, tenacious saliva escaped from the mouth; made no attempt to drink when water was placed before her and when walking exhibited marked symptoms of inco-ordination. The rectal sphincter was apparently paralyzed.

The animal was killed by bleeding and the central nervous system examined. There was marked congestion of the meninges, especially at the base of the brain, where the tissues surrounding the pituitary body was infiltrated with a blood clot (?) closely resembling that observed in Taunton animal (rabies case No. 63).

Cultures were made from the meninges; and the cortical portion of the right frontal lobe of the cerebellum was preserved in 96 per cent alcohol.

A similar portion from the left side was collected in a sterile Petri capsule and a portion of the medulla was collected in a sterile flask, brought to the laboratory and used for inoculating rabbits Nos. 478-79. These two animals died in 20 and 21 days respectively after exhibiting symptoms of rabies. From rabbit No. 478, a second series of rabbits, Nos. 497 and 498, were inoculated. These also died of rabies.

Outbreak 61—*Minneapolis* (*Dog*).—Dec. 9, Dr. Annand was called to treat a dog in S. E. Minneapolis, and found the dog in a paralytic stage of rabies. A police officer destroyed him.

Outbreak 62—*Fridley* (*Dog*)—*Case No.* 68.—Dec. 8, 1901, a mongrel dog, the property of O. P., Fridley, Minn., was noticed by the hired man acting queerly. Dog left home on the night of Dec. 8th and bit several dogs in the neighborhood. Monday, December 9th, at about 10 a. m., dog attacked and bit a two-year-old heifer, the property of Mr. T. D. K. The dog was then shot.

The dog was brought to the laboratory Dec. 11, 1901, at 5 p. m., by Messrs. L. H. H. and T. D. K., of Fridley, Minn.

Examination of dog next morning at 9:30 showed that he had been killed by shooting with both rifle and shot gun. The skull had been fractured and the brain substance macerated. The head was cut off by sawing between the axis and atlas, the end of the cord flamed, a portion of the medulla removed and placed in a sterile dish. Direct coverslip preparations and cultures from the medulla showed no bacteria. Rabbits Nos. 480-481 were inoculated with an emulsion made from sterile broth and a portion of the medulla. These rabbits died in 20 and 17 days respectively after showing symptoms of rabies. From rabbit No. 481 a second series, rabbits Nos. 499 and 500, were inoculated. These died in 19 and 21 days respectively of rabies.

Outbreak 62 *Cont'd*—*Fridley* (*Dog*)—*Case No.* 69.—Saturday, Dec. 14, 1901, the head of a shepherd dog was brought to the laboratory by Mr. L. H. H., of Fridley, Minn. This dog belonged to W. S. He said it had been bitten by O. P.'s dog (Laboratory case No. 68). which developed rabies on Dec. 8, 1901. The S. dog had been kept chained since bitten and is known not to have bitten any animals or persons. On December 13th the dog attempted to bite the persons feeding it and on suspicion of having rabies was shot.

The head was placed out of doors and kept frozen until Dec. 16th, 1901, when the neck was sawed off near the head, the cord and surrounding tissues cauterized and a portion of the medulla removed. An emulsion was made from this and two rabbits, Nos. 480-81 inoculated subdurally.

These animals showed no symptoms during the ensuing eight months, after which time they were used for another purpose.

Mr. H. was communicated with on January 29th and February 26th, and it was pointed out that presumably in this dog which had

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[*] Biennial Report 1899-1900, page 576.

been bitten only five days before it was killed, rabies virus had not yet time to develop and be present in its nervous system. This view of the case still holds. It is perhaps of some importance when considered in the light of former work done in this laboratory* in which it was shown that after subdural inoculation of fixed rabies virus, it was possible to demonstrate its presence in the central nervous system of the inoculated animal at any time from the date of inoculation until the appearance of symptoms and death of the animal from rabies.

Outbreak 63—*Porter* (*Dog*).—Dec. 17, 1901, Mr. L. I. Leland, Chairman Board of Supervisors, Porter, Minn., reported to this board that a dog in the township of which he was chairman had "gone crazy, killed some neighbor's chickens and when he came home again bit a puppy and a calf. The owner tried to kill him, but the dog left home and was not seen again."

The owner had been going past Mr. J.'s place near Taunton (see rabies cases No. 63 and No. 66) and the dog may have been bitten by Mr. J.'s dog. Mr. Leland was requested to report any further developments of cases in his township, but nothing more was heard from him. From the history, it would appear that the case was probably one of rabies.

Outbreak 64—*Merriam Park* (*Hog*)—*Lab. No.* 70.—Mr. J. L., Route 1, Merriam Park, Minn., brought to the laboratory on Dec. 26, 1901, the head of a pig which had been removed a few hours before, when it had been found dead. The hog on the previous day had shown loss of appetite and a tendency to retire into corners, snapping its jaws and "foaming" at the mouth. A history of the hog having been bitten by a dog on December 7th was given.

From the medulla of the hog, two rabbits, Nos. 494-95, were inoculated. These succumbed in 22 and 14 days respectively. From rabbit No. 494 two other rabbits, Nos. 508-509, were inoculated on Jan. 18th. Rabbit No. 508 developed pneumonia (both lungs) and to relieve its suffering was killed on February 10th. Rabbit No. 509 was still alive and apparently well at the end of eight months, when it was used for another puropse.

A positive diagnosis of rabies was transmitted to Dr. Brimhall on February 1st, owing to the findings in the first pair of rabbits inoculated, the second pair being alive at that time.

In view of the fact that of the two rabbits of the second series, one showed diplococci at autopsy and the other remained alive and well for eight months, it is possible that this diagnosis of rabies was not warranted, and that the case may have been originally one of meningitis. It should, however, be mentioned that no bacteria were demonstrated in the original material from the hog's brain. The case illustrates the desirability of inoculating more than one series of animals and awaiting the results of such inoculations before giving a positive diagnosis in doubtful cases.

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*See Biennial Report Minn. State B'd of Health, 1899-1900, page 576.

Outbreak 65—*Minneapolis, Hennepin Co.* (*Cow*) *Lab. No.* 71.—Dr. C. C. Lyford brought to the laboratory Feb. 3, 1902, at 4:30 p. m., the head of a heifer, the property of Mr. A. R. T., a dairyman, who lives just above Shingle Creek on the River road, Minneapolis. Dr. Lyford gave the following history:

"Mr. T. first noticed in the morning when he started out that a pup (about eight months old) which belonged to him, began to jump and run after the cows and catch them by the tail. He could not call him off, or make him stop, so he caught him and gave him a whipping. The dog followed Mr. T. to the horse barn. On opening the door, the dog caught a chicken, shook her and broke her neck. He whipped him again and as soon as he let him go, he ran around the barn and ran after some young cattle in the adjoining yard, when he is supposed to have bitten this heifer. Mr. T. knew that he had caught some of them by the tails, but did not know whether it was this one. This was about six or eight weeks ago. Mr. T. then called the dog to the house and while Mr. T. was sitting at breakfast, the dog began to howl and make a good deal of noise. As soon as Mr. T. got breakfast he went down town and did not get back until noon. Mrs. T. says the dog continued to howl until about 10 a. m., when he started up the road. He next went to the first neighbor's and killed about six chickens; the next place he went he got into the pig pen and bit some of the pigs; the next place he went he killed several ducks. Here the woman shut him up in an outhouse with one of the ducks and waited until her husband got home when he killed the dog by shooting."

Mr. T. telephoned Dr. Lyford that prior to that time they had a tramp dog that had killed several chickens and bit other dogs. He knew the dog in question was bitten. The tramp dog was killed when he began to show signs of being ugly. This was about the latter part of July or 1st of August, 1901.

"The heifer was paralyzed behind; could raise herself probably a foot from the ground and could only carry herself for five or six feet at a time. Heifer would start to bellow and hurry up as fast as she could; she would then fall and straighten out and have a sort of spasm, bellowing for three or four minutes. She looked wild. She would not drink water and had not eaten anything for a couple of days. On the morning she was taken ill, she was running around the yard lame and weak behind, but could walk. By night she became so paralyzed that she could not rise or move in any way. She had paralysis of the bladder; and could not pass urine. There was a good deal of straining. Every 10 to 15 minutes she would have one of those bellowing spells." Dr. Lyford saw animal on Jan. 30th, at 1:30 p. m. She died on Friday night, Jan. 31, 1902.

Head was put in ice chest until morning of Feb. 4th. Two rabbits, Nos. 518-519, were inoculated subdurally with an emulsion of medulla from the head.

Under date of March 20, 1902, Mr. A. R. T. communicated the following further information: "Another one of my milch cows came down with the disease (rabies) the early part of this week and died yesterday having shown symptoms of rabies for only about two days. I had both the heifer and the cow cremated at the crematory at the workhouse, which is a mile south of my farm."

The first pair of rabbits inoculated from the heifer in this case, namely Nos. 518-519, died in 17 and 20 days respectively after having shown symptoms of rabies. A second series, rabbits Nos. 526-527 were inoculated from rabbit No. 518 and died after 63 and 68 days respectively. A diagnosis of rabies was made in the case.

Outbreak 66—*Belle Plaine, Scott Co.* (*Dog*)—*Lab. No.* 72.—Feb. 19, 1902, there was received in the laboratory, an express package which had been addressed to the State Experiment Station. After telephoning the Station, the box was opened in the laboratory and it was found to contain a small yellow dog and the following note:

> Belle Plaine.
>
> To be examined for rabies. This dog and three others were bitten by a strange dog three weeks ago. All three showed typical symptoms of rabies, and have died after being sick 48 hours.
>
> DR. F. J. BOHLAND-FUCHS.

From the medulla of the dog, two rabbits Nos. 524-525 were inoculated subdurally. These animals developed symptoms of rabies and died in 29 and 23 days respectively. From the medulla of rabbit No. 525, rabbits Nos. 532-533 were inoculated subdurally. Of these, rabbit No. 533 succumbed to rabies in 23 days. Rabbit No. 532 showed no symptoms during the ensuing six months, after which time it was used for another purpose.

Dr. Bohland-Fuchs was asked for further information concerning this outbreak on two occasions, but none was received from him.

Outbreak 67—*Fridley, Anoka Co.* (*Dog*).—Feb. 26, 1902, Mr. L. H. Hoyt, Town Clerk of Fridley, Minn., brought to the laboratory the head of a dog. Mr. Hoyt gave the following history:

Feb. 24th at 10:30 a. m., a strange dog, gaunt in appearance and having an uncertain gait, was observed passing through the town of Fridley. He was seen to fight and probably to bite two dogs. He passed on across the river to the town of Brooklyn Center, where he fought with and probably bit two dogs, the property of Mr. C. H. J., near Osseo. The dog was followed from Fridley by Mr. Hoyt and several other citizens. Shortly after he attacked Mr. J.'s dogs he was shot through the head. The brain was much torn to pieces by the shot. The head was removed from the body and brought to the laboratory by Mr. Hoyt, who reported that the two dogs above noted in the town of Fridley, were already muzzled and would be kept muzzled or confined for some months unless they in the meantime showed symptoms of rabies.

On examination in the laboratory, the brain of the dog was found to be so completely destroyed that it was impossible to obtain material for inoculation.

Outbreak (?) 68—*Howard Lake, Wright Co.* (*Cow*)—*Lab. No.* 73.—March 13, 1902, there was received in the laboratory a bottle of milk from Howard Lake, Minn., accompanied by the following data:

> In another package, you will find a sample of milk from a cow that is supposed to have been bitten by a mad dog 16 days ago. She has attacks of being restless with loud bellowing. She looks all right aside from that. She eats and drinks as usual after the attacks.
>
> A. G. MOFFATT, M. D., H. O.

Rabbits Nos. 534-535 were inoculated subdurally with a portion of the milk received. They showed no symptoms during the ensuing three months.

A telephone message received from Dr. Moffatt several weeks later said that the cow had recovered. The case was evidently, then, not rabies.

Outbreak 69—*Oronoco, Olmsted Co.* (*Hog*).—March 14, 1902, there was received in the laboratory, the brain of a hog from Oronoco, Minn., accompanied by the following letter:

> I am a butcher here and have some hogs that are ready to kill. We had a mad dog here that bit a number of cattle and hogs. I lost a sow that was about to pig. She got too much feed. I will send the brain for examination to see if I may kill the others. F. A. C.

The specimen when received was in an ordinary fruit jar, completely putrified and in a semi-fluid condition. It was therefore impossible to make any inoculations. It would appear from Mr. C.'s letter that the animal was not suffering from rabies. It is mentioned here only because of its possible connection with the next case.

Outbreak 69 *Cont'd—Oronoco, Olmsted Co.* (*Dog*)—*Lab. No.* 74. —March 24, 1902, there was received in the laboratory, the head of a small mongrel dog, wrapped in oil cloth and packed in sawdust, from Mr. E. J. Rice, Town Clerk, Oronoco Twp., Oronoco, Minn. On request, Mr. Rice gave the following information concerning the case:

"The dog's head sent you was the one which appeared in this vicinity January 27th, the origin of which is unknown. I cannot say positively if this dog was killed January 28th or 29th. During the interval between January 27th and the time it was killed, the dog bit a number of animals on places in this vicinity. After the dog was killed, the body froze very quickly and remained frozen until it was sent to you. Twenty days after being bitten by this dog a two-year-old heifer belonging to Mr. F. W., of Oronoco, began to act strangely. It would strike at any one coming near and it frothed at the mouth. Finally it was killed. Another animal, a yearling belonging to Mr. J. L., of Oronoco, had been bitten by a dog about January 27th. About 30 days later this animal showed symptoms similar to those in the heifer. It ate nothing, broke all boxes and boards within reach and was killed about eight days after first being noticed. Still another animal belonging to Mr. J. L. acted the same after about 40 days. It was killed four days after becoming sick. All of these cattle were buried. The hog belonging to Mr. F. C., of Oronoco (see previous case) was affected similar to the above animals about 35 days after the dog was known to be in this vicinity. It was not known, however, that the dog had been near the hog. The hog was killed and the head sent to you for examination."

Under date of April 4, Mr. Rice again wrote: "No other cases of rabies have broken out since those previously reported."

From the medulla of the dog mentioned above, two rabbits, Nos. 536-537, were inoculated subdurally. One of these, No. 536, died in 19 days after having exhibited symptoms of rabies and the other, No. 537, showed no symptoms during the ensuing six months, after which time it was used for another purpose. A second series of rabbits, Nos. 546-547, were inóculated from rabbit No. 536. Rabbit No. 546 died after 23 days, of rabies. Rabbit No. 545 showed no symptoms during the ensuing six months.

Though two of the inoculated animals in this case failed to die of rabies, there can be little doubt that the dog from which the material was obtained had been suffering from this disease when killed. The failure to obtain positive results with all of the rabbits may have been due to the fact that the material had been frozen for 55 days before it was used for inoculation.

Outbreak 70—*Cannon Falls, Goodhue Co.* (*Dog*)—*Lab. No.* 75. —March 31, 1902, there was received in the laboratory from Cannon Falls, Minn., the head of a dog accompanied by the following history:

> This dog bit a boy yesterday. The dog came into the yard and the boy, L. F., tried to drive him away. He bit the boy on the hand and then ran after the cows and bit at one but she kicked him over. A girl in the family threw a stone at him and he tried to bite her, but she got out of his way. He then went to a neighbor's. The man was at the barn and the dog attempted to bite him. The man knocked him over with a club. He then went to another neighbor's and went into the barn. They tried to drive him away but he would not go. He was still there this morning. He seemed stupid and sick, but did not attempt to bite. He had no spasms. They killed him and skinned and buried him. When it was reported to me. I told Mr. F., whose son had been bitten, to get the head and I would send it to you for diagnosis.
>
> H. E. CONLEY, M. D., H. O.

From the medulla of the dog noted above, rabbits Nos. 539-540 were inoculated subdurally. These died after 24 ad 25 days respectively, having shown symptoms of rabies. From the medulla of rabbit No. 539, a second series was inoculated, Nos. 553-554. These also died after 30 and 23 days respectively, having shown symptoms of rabies.

The boy, L. F., who had been bitten by the dog noted above, was sent to the Pasteur Institute at Chicago, where he was given the Pasteur treatment. He developed no symptoms of rabies.

Outbreak 71—*Arlington, Sibley Co.* (*Dog*)—*Lab. No.* 76.—April 8, 1902, there was received in the laboratory, the head of a dog accompanied by the following letter from Arlington, Minn.:

> Send you by U. S. Express, head and neck of a dog who died sometime Sunday night, April 6th. Did not see the dog, but have been informed that he bit three children and that one of them left for Chicago this afternoon to

take treatment. Saw one of the children yesterday that was bitten Friday of last week. There were two small wounds but healed. During Friday and Saturday of last week, dog was cross to other dogs and Saturday afternoon he left home. The owner of the dog can give no information as to whether the dog showed any signs of rabies or not.

(Signed) M. E. BUSHEY, M. D., H. O.

In another communication dated April 15th, Dr. Bushey says:

Referring to rabies case No. 76, would say that the name of the owner of the dog is Wm. S. His son was bitten in the hand and no treatment was used until the fourth day. There was just a slight abrasion of the skin. I saw the hand on the fourth day and cauterized the wound and applied only collodion dressing. A Mr. H. and his son were also bitten, the man on the foot and the boy on the hand. A son of Mr. T. S. was bitten on the hand. I can learn nothing in regard to other dogs being bitten by this one. When he went out into the country, a large black dog belonging to a farmer caught this dog which was a small one across the neck and hurt him internally as was shown by the post-mortem examination. Mr. S. took his son to Chicago for treatment. The H.'s. so far as I know, did nothing to the bites.

(Signed) M. E. BUSHEY.

The head of the dog when received in the laboratory was packed in a tin pail, without ice, but was in fairly good condition. From the medulla of the dog in this case, rabbits Nos. 543-544, were inoculated subdurally, and died after 20 and 19 days respectively, having shown symptoms of rabies. A second series of rabbits, Nos. 556-557, were inoculated subdurally from the medulla of rabbit No. 543. These died after 48 and 25 days respectively, having shown symptoms of rabies. From rabbit No. 556, which had lived 48 days after its inoculation, a third series of rabbits were inoculated, Nos. 571-572. Rabbit No. 571 died on the day following the inoculation. At autopsy, a general œdema with a large amount of fluid in the peritoneal, pericardial and pleural cavities was found. Rabbit No. 572 died after 23 days, having shown symptoms of rabies.

Outbreak 72—*Sand Creek, Scott Co.* (*Cattle, Swine, Dogs and Goats*).—April 17, 1902, Mr. Peter Poetz, chairman of the local board of health, of Sand Creek Twp., Scott Co., reported to the Veterinary Department of the State Board of Health that on the farm of Mr. E. H., 10 hogs had died and six were sick at the time. Mr. Poetz said he thought the hogs were suffering with "some kind of hog diphtheria," and that he had put up a hog cholera notice temporarily, though there were no symptoms of hog cholera. He gave an indefinite history of the hogs having been bitten by a mad dog some time before.

Under date of April 19, 1902, Mr. Gottlieb Piere, chairman of the local board of health, of Jordan, Minn., also reported a similar disease among hogs on the farm of Mr. H. K.

The above reports were a long time in reaching the State Board of Health, but immediately upon their receipt, Dr. Annand was sent, April 30th, to investigate the disease. The facts collected were as follows:

"About Feb. 20, 1902, a supposedly mad dog passed through this section of country. He is supposed to have bitten dogs belonging to Mr. O. H., of Louisville Twp.; Mr. C. F., of Jordan; Wm. D., T. B. and J. H., of Sand Creek Twp., Scott Co. He bit a number of hogs and other stock on the places of Mr. E. H. and Mr. H. K., who lived seven miles apart in Sand Creek Twp. The dog was killed on the place of Mr. K. On the farm of Mr. E. H., two hogs died about two weeks after the visit of the dog. Both of them showed the violent, excitable symptoms of a rabid animal. Eight other hogs died between March 10th and April 17th. All of them were violent for a short time, but exhibited the symptoms of the so-called dumb form of rabies more markedly.

On the farm of Mr. K., the dog had bitten two goats, one steer, one bull and seven pigs. The first to show symptoms was a she goat, which began to act strangely on March 17th and was killed by the owner on March 19th. One pig on the 21st of March "went crazy" and was killed on March 22d. One pig showed symptoms on March 22nd and died on March 23rd. One pig showed symptoms March 23rd and was killed on the same day. One pig showed symptoms on March 27th and was killed on the same day. One sow showed symptoms on April 1st and was killed on April 2nd. Seven small pigs were suckled by this sow until April 1st at noon. None had shown any symptoms at the time of Dr. Annand's visit, April 30th. One she-goat showed symptoms April 2nd and was killed the same day. One pig showed symptoms April 2nd and was killed at once. One steer showed symptoms April 7th and was killed the same day. One sow showed symptoms April 12th and died April 14. Fourteen pigs were suckled by this sow, to April 12th at noon. All of the pigs were alive and well at the time of Dr. Annand's visit, April 30th. From the owner's description there could be no doubt that the animals had rabies. The pigs would make a barking noise, chew the pen, dig with their front feet into the ground and would bite everything that was placed in front of them. The goats would start "blatting" and then later would run about and fight and bite any animal which came in their way. The steer attempted to bite and chase the other cattle. When the owner threw sticks and stones at the animal, it would chase them as long as they rolled. In this manner by throwing rocks ahead of the steer, the owner guided the animal into the field where he wished to bury him.

Outbreak 73—*Brooten, Stearns Co.* (*Dog*).—Under date of April 24, 1902, Dr. W. S. Leach, H. O., of Brooten, Minn., wrote to this Board as follows:

> Has the village board of health power to order a chained-up dog to be killed, the said dog having been bitten by a supposedly rabid dog. A large St. Bernard dog in this place about ten days ago went mad and bit four other dogs and then attacked its master. All of the dogs have been killed except one, the owner of which refuses to kill or muzzle him. It is kept at home tied with a rope.

The requested information was given Dr. Leach and he was asked to report further developments. Nothing more was heard from him.

Outbreak 74—*Northfield, Rice Co.* (*Dog*)—*Lab. No.* 77.—May 28, 1902, there was received in the laboratory, the head of a dog from Northfield, Minn. Accompanying the specimen was the following letter:

> We send you by express this afternoon, the head of a dog which died this morning. The dog had been sick since May 21st. The lady whom he bit goes to Chicago to-night for treatment. I think from the symptoms this was a case of hydrophobia. The dog passed through the stage of excitement, manifesting great nervousness, extreme restlessness and snapping at everything approaching him. He then became more quiet and in 48 hours passed into the stage of paralysis of the limbs, lower jaw, etc. The voice was changed.
>
> E. E. BRUBAKER, M. D., H. O.

On inquiry Dr. Brubaker furnished the following additional information: "Dog had been chained up for some time before she showed symptoms of rabies. She had no opportunity of biting any other animal or dog, save the owner's dogs, one of which she bit. However, they killed both of the other dogs on the farm. Nothing is known as to how this dog became infected, as she had been chained up for some time, although the owner says that about three weeks before this dog became sick, they were aroused one night by a disturbance among the dogs. The owner went out and saw a strange dog in the yard, but did not shoot it for fear it might belong to some neighbor. The name of the woman bitten was Mrs. G. R., Randolph, Minn. The wound was located at the ankle of the right leg. There were several punctures of the skin in one of which the tooth penetrated to the depth of an inch or more. The other two were about one-half inch deep. The skin was broken with superficial scratches from the teeth all around the ankle. I saw the case about three and one-half or four hours after she was bitten, and cauterized the wound thoroughly with silver nitrate, both deep and superficial. The subsequent treatment consistetd in bathing the parts in 1-1000 bi-chloride solution and covering the surface with a mixture of Fuller's earth and glycerine."

Under date of August 6th, 1902, Dr. Brubaker wrote:

> Mrs. R. went to Chicago for treatment and was there three weeks. She is still well. It is now 75 days since she was bitten.

From an emulsion of the medulla of the dog in this case, two rabbits, Nos. 565-566, were inoculated subdurally. These died in four and 13 days respectively. From the original material and from the tissues and central nervous system of both of this pair of rabbits, a bacillus of the colon group was obtained.

From rabbit No. 566, a second pair of rabbits were inoculated, Nos. 567-568. These rabbits died at the end of 19 days. No bacteria were obtained from the cultures in either case.

From the medulla of rabbit No. 567, a third series of rabbits, Nos. 579-580, were inoculated. One of these died after 65 days and the other exhibited no symptoms during the ensuing six months.

It will thus be seen that while the history of the symptoms in the dog were strongly indicative of rabies and both of the first pair of rabbits died after the usual incubation period of rabies in a rabbit and after having exhibited symptoms resembling rabies, yet a shadow of doubt remains in the laboratory diagnosis, owing to the indefinite results in the third series of rabbits and to the finding of bacteria in the original material and in the first series of rabbits.

Outbreak 75—Clearwater, Wright Co. (Steer, Hog).—The only information concerning this outbreak is contained in the following letter:

> Clearwater, Minn., June 2, 1902.
>
> Dr. H. M. Bracken, St. Paul, Minn.:
>
> About a month ago I had a strange dog get among my stock. Several hogs and some cattle were bitten by him. I had the dog killed. Last week I lost one of my hogs and to-day a steer. Both of the animals that died frothed at the mouth, rolled and kicked as if in spasms and neither of them would take food or water. It lasted about two days. Is it hydrophobia?

If so, is there anything that can be done for the animals as late as this? Is there any harm in using the cow's milk? They all seem in perfect health as yet. I have a litter of pigs a week old from a sow that I saw the dog bite. Had I better take the pigs away?

(Signed) H. A. W.

Mr. W. was immediately communicated with, given the information he requested and asked to keep the Department informed of any further developments. Nothing more was heard from him.

Outbreak 76—*Rogers, Hassan Twp., Hennepin Co.* (*Dog*).—May 24, 1902, there was received from Mr. E. S. Wiggins, C. B. S., Rogers, Hassan Twp., Hennepin Co., a letter of which the following is an abstract:

"Am seeking information concerning rabies. A few days ago a dog, owner unknown, went on a raid through this neighborhood. In the course of his travels he bit a number of hogs belonging to one man. Since then the hogs have shown symptoms of being crazy or mad. The man has killed a part of them and has notified the town board through me. The dog was not killed or caught, and it is supposed that he bit several dogs in the course of his travels. What action should the township take in the matter? Can the man recover for the loss of his hogs?"

Mr. Wiggins' questions were answered and he was asked to give information concerning any further cases.

Outbreak 76 *Cont'd—Rogers, Hassan Twp., Hennepin Co.* (*Hog*).—June 10th, 1902, there was received by the Secretary of this Board, a letter of which the following is an abstract:

Five weeks ago to-day our hogs were bitten by a mad dog. Since then 22 have died with rabies. The dog was in the yard when the hired man got up in the morning. He chased the dog away without suspecting anything wrong. As soon as my husband knew of it, he arose and followed the dog's tracks (it having rained in the night) to a railroad crossing three miles away. That was the last seen of the dog.

(Signed) Mrs. T. DeM.

Mrs. DeM. was written to and asked to supply information concerning further cases, and also Mr. E. S. Wiggins, C. B. S., was again requested to report any further cases of rabies.

Under date of June 20th, Mrs. T. DeM. again wrote saying that another hog was sick.

June 21st, Dr. Brimhall visited the locality and investigated the report. The history obtained at this time was as follows:

May 4, 1902, a strange dog came into the neighborhood and on the farm of Mr. G. DeM., bit a large hog. From there he went to the farm of Mr. T. DeM., got into the yard with a herd of hogs and bit a number of them severely. The dog was seen with a number of other dogs, and most of these had been killed at the time of Dr. Brimhall's visit.

Two weeks after the appearance of the dog the hog which he bit on the farm of Mr. G. DeM. began exhibiting symptoms which, as described by the owner, were indicative of rabies. The animal died after three or four days' sickness. About the same time, the hogs on the farm of Mr. T. DeM. began to "act crazy" and exhibit the usual symptoms of rabid animals. In all on this farm, at the time of Dr. Brimhall's visit, 23 hogs of different ages had died or been killed after exhibiting symptoms of rabies. On the farm of Mr. R., residing a mile or two from Mr. T. DeM.'s place, two cows and one calf had died in the three weeks just prior to Dr. Brimhall's visit, after exhibiting symptoms of rabies. Two cows had died of apparently the same disease on the farm of Mr. A. DeM., who lived a short distance from Mr. T. DeM.

At the time of Dr. Brimhall's visit there was reported to the State Board of Health for the first time, the death of a dog belonging to Mr. D. T., near Mr. T. DeM.'s place, which had gone mad during the winter or early spring of 1902. Also the death of two dogs belonging to Mr. J. C., which were killed on account of the disease during the winter of 1902. It was also reported that two years previously, a dog went through the same vicinity and bit a number of animals, of which one cow, three calves and 11 hogs died after exhibiting symptoms of rabies.

At the time of Dr. Brimhall's visit, one hog, three months old, was sick on the farm of Mr. T. DeM. This animal was taken sick June 19, 1902. It was biting at all objects about him. It squealed almost constantly as though in pain and tried to crowd itself into small corners. The hog was killed June 21st and the head shipped to the laboratory, where it was received June 23, 1902. (Case 78). From an emulsion of the medulla of this hog, rabbits Nos. 577-578 were inoculated subdurally. Both animals died after 26 and 21 days respectively, having shown symptoms of rabies. From rabbit No. 577, a second series of rabbits were inoculated, Nos. 581-582. These animals died after 62 and 68 days respectively.

Under date of Aug. 24, 1902, Mr. T. DeM. again reported to this Board that he had lost two more hogs. One died June 25th and the other Aug. 23rd.

Under date of Sept. 18, 1902, he reported the loss of another hog, which was taken sick September 17th, thus making a loss of 26 hogs out of a herd of 31.

If the last two hogs were infected originally from the dog, the incubation period must have been 95 and 120 days respectively. If, on the other hand, they were infected from the last hog which died prior to them, the incubation periods were 59 and 84 days respectively.

Outbreak 77—*Waconia, Carver Co.* (*Dog*).—Under date of July 4, 1902, Dr. H. I. Grivelly, of Waconia, Minn., reported to this Board, a case of rabies in the following letter:

> I was called to see a boy named F. S. last Saturday. He had been severely wounded by his father's dog. The wounds were located on the lower extremity. Besides this boy, the dog had attempted to bite another child but had not wounded it. He had bitten a hog, another dog and had killed two turkeys. I found the dog chained and scratching and biting at everything in his way. He showed a general disposition to tear wood, clothing, etc., to pieces. His conjunctivæ were congested and the skin on the forehead and over the eyes wrinkled. There was no froth from the animal's mouth. He was constantly moving about, searching, scraping and barking without any object. His bark was hoarse and of a peculiar sound. I ordered them to let the dog live for further examination. On June 29th, 1902, I found the dog trembling, dull, depressed and quiet, to some extent. He had a partial paresis of the hind extremities and a swaying motion in walking. He tried to jump a fence near his home and hung thereon. To prevent further mischief, Mr. S. shot the animal.
>
> The other bitten animals were also killed and burned, together with everything around the dog's kennel.
>
> The patient was sent to Chicago for treatment for rabies.
>
> (Signed) H. I. GRIVELLY.

Nothing further was reported to the State Board of Health from this outbreak.

Outbreak 78—*Blooming Prairie, Steele Co.* (*Dog*).—Aug. 4, 1902, Dr. E. W. Cooley reported a case of rabies from Blooming Prairie, Minn., as follows:

"The first animal to show symptoms was a dog, the property of M. F., Blooming Prairie, Minn. The dog became sick July 9th. The dog constantly tried to bite people and objects. He frothed at the mouth. The animal bit his master July 11th, on which date he was killed. Mr. F. went to Chicago on July 13th to take the Pasteur treatment and returned on July 27th. He was still well on Aug. 4. 1902.

Outbreak 79—*Annandale, Wright Co.* (*Dogs, Calf*).—July 20, 1902, an apparently rabid dog visited the farms of Mr. G. W. K., Mr. A. O., Mr. M. P., Mr. H. H. and Mr. J. H. On Mr. K.'s place the dog bit the house dog. This latter animal was killed July 25, 1902.

On Mr. A. O.'s place the dog bit two dogs and a calf. The dogs were killed July 21st. The calf showed symptoms of rabies Aug. 7, 1902.

On the place of Mr. M. P., the dog bit one dog. This animal was killed July 25, 1902.

On Mr. H. H.'s place, the dog bit seven hogs and was here killed. No information has been received concerning the fate of the herd of hogs.

On Mr. J. H.'s place the dog bit one dog, which was immediately killed.

Outbreak 80—*Kiester Twp., Blue Earth Co.* (*Cattle*).—Aug. 5, 1902, Drs. Brimhall and Wesbrook went to Kiester Twp., Blue Earth Co., in answer to a telegram from Mr. W. O. Conrad, chairman of the Board of Supervisors, stating that cattle were dying of an unknown disease. They found that cattle had died with hydrophobia, one owner having lost three head in the previous three months. The last one died some days before and was buried.

Outbreak 81—*Maple Lake, Wright Co.* (*Dog*).—Under date of Aug. 15, 1902, Mr. E. A. Hart, C. B. S., of Maple Lake, Minn., reported as follows:

"A dog came through the town of Albion in July and bit several dogs and calves. Some of these have gone mad and been killed. Some have not yet gone mad, but are being watched."

Mr. Hart was asked to send a full report on the cases, but nothing further was heard from him.

Outbreak 82—*Dexter, Mower Co.* (*Cow*)—*Lab. No.* 79.—Aug. 14, 1902, Dr. Annand visited the farm of Mr. O. O., at Dexter, to investigate the cause of trouble in a herd of cattle, the property of Mr. O. A supposedly mad dog had passed through the locality about the middle of July, 1902. The dog had fought with Mr. O.'s dog. About three weeks later Mr. O.'s dog developed rabies and was shot. Two or three of the neighbors' dogs had fought with the strange dog and they also developed rabies and either had died or been killed.

On Dr. Annand's arrival, he found one animal down and unable to rise. Another animal, a steer, had evidently died from rabies.

The sick cow was killed and a post-mortem examination made at once. There were no gross lesions except general congestion of the meninges.

Specimens from the medulla of the cow were brought to the laboratory, Aug. 15, 1902, at 7 p. m., and were inoculated Aug. 16, 1902, into rabbits Nos 590-591. These two rabbits died after two and one days respectively. Cultures from the original material and also from the meninges of both rabbits gave an abundant growth of *B. coli communis* and another small bacillus.

Whilst the clinical symptoms would seem to warrant a diagnosis of rabies, a laboratory diagnosis was thus doubtful owing to contamination in the material and consequent death of the inoculated animals from bacterial infection.

Outbreak 83—*New Market, Scott Co.* (*Cattle, Dog*).—Under date of Aug. 20, 1902, Mr. N. A. Frederickson, C. B. S., of New Market Twp., Scott Co., gave to the Board the following information:

"Mr. K. K., of New Market Twp., Scott Co., lost six cows in the last few weeks, the last one 10 days ago. A mad dog was at his place some weeks before the first cattle got sick and bit his cattle."

Under date of Aug. 29, 1902, Mr. Frederickson made a formal report of the death of six cows and one dog on the farm of Mr. K. K., and gave the additional information that the dog had gone mad and bitten Mr. K. K.'s daughter and that the girl had been taken to Chicago for treatment.

On communicating with Dr. J. A. Sanford, New Market, Minn., the following information was obtained:

"About six weeks ago (August 10th) Miss K. came to my office with a dog-bite on her leg. I inquired about the dog. The symptoms as described showed rabies. The dog had bitten another little boy and several cattle and had already been shot. I advised the girl to go to Chicago and take the Pasteur treatment. Dr. Phelps, of Northfield, also gave her the same advice and she went. I advised the parents of the little boy to send him also, but he is at home and still well. I advised Mr. K. to keep his cattle confined to a yard or barn, and I am certain that he has done so."

Outbreak 84—*Shakopee, Scott Co.* (*Dog*).—Aug. 25, 1902, there was received in the laboratory a portion of the brain and spinal cord of a dog from Dr. H. O. Smith, of Shakopee, Minn. Accompanying the specimen was the following letter:

Shakopee, Minn., Aug. 22, 1902.

Dr. H. M. Bracken:

I send you by express today a section of the spinal cord and brain of a dog that created quite a stir here yesterday. The dog acted strangely and bit at least a dozen other dogs here. We finally located him and shot him. He was quite a large dog, but thin. He would attack a person as eagerly as he would another dog. The specimen is not as good as I could have wished, but it is as good as we could obtain after he was killed. Will you have it tested for rabies and let me know the results as soon as possible? I have quarantined all the dogs known to have been bitten, and have advised all persons to keep their dogs at home until we know positively whether there is any danger or not.

(Signed) H. O. SMITH, M. D., H. O.

The specimen when received in the laboratory Aug. 25, 1902, *i. e.* four days after having been removed from the animal, was so much decomposed that a laboratory examination was impossible. Dr. Smith was advised of this fact and requested to send specimens from other dogs should any become affected.

Shakopee, Scott Co. (Dog)—Lab. No. 80.—Accordingly on Sept. 10, 1902, there was received in the laboratory another specimen from Dr. Smith, accompanied by the following letter:

Shakopee, Minn, Sept. 10th, 1902.

Dear Doctor: I send you by express today the head and neck of a dog killed last evening, for examination for rabies. This dog was bitten on Aug. 21st, 1902, by the dog whose brain and spinal cord I sent you at that time and which was so decomposed before you received it that it was not fit for use. This dog has been quarantined since August 21st. He first began to get sick Sept. 6, 1902. He refused to eat or drink and appeared stiff and sore. The lips were drawn so that the teeth showed plainly. He seemed to have difficulty in swallowing and had attacks of restlessness. He seemed frightened and howled fearfully. The dog finally broke away and was shot by a policeman. I have posted a notice that all dogs must be muzzled for a period of 60 days, and have taken all the precautions that I can, but there are so many dogs that may have been bitten without anyone knowing it that it is almost impossible to quarantine all that should be under quarantine.

(Signed) H. O. SMITH, M. D., H. O.

When the head was received in the laboratory it was in good condition, having been wrapped in an oil cloth, placed in a tin pail and the pail packed in ice. From the medulla of the dog, two rabbits, Nos. 594-595, were inoculated subdurally. One of these rabbits, No. 595, died at the end of 63 days without showing any symptoms of rabies. The other remained alive and well for six months, after which time it was used for another purpose.

Thus it will be seen that the laboratory diagnosis was negative, despite the typical clinical history of rabies in the dog from which the material was obtained.

Outbreak 85—*Granite Lake, Wright Co. (Dog, Cattle, Etc.).*—Oct. 14, 1902, Dr. E. Y. Chilton, of Howard Lake, Minn., notified this Board that rabies existed in the town of Albion, Wright Co., and requested that instructions concerning quarantine, etc., be sent to Mr. J. L., Granite Lake, Wright Co.

After communication with Mr. L., the following letter was received:

Granite Lake, Minn., Oct. 20, 1902.

About three months ago my neighbor's little dog appeared to be wild. He came to my place and began biting and fighting with my dog. The next day he was killed, after he appeared to be sick. About six weeks later my dog started to bark like the neighbor's dog. He would not eat anything. He ran after the cattle and jumped on the cat and bit it badly. His eyes were red and he foamed at the mouth a little. I killed him and the cat at once. At this same time two of my hogs also got sick. They seemed to go totally blind. One died shortly after we noticed that he was sick and the other lived three days. The hogs did not try to bite anything. About four weeks after this, or Oct. 8, 1902, one of the cows became sick. She would go by herself and lie down in the pasture. We put her in the barn and kept her there until the 12th, when we let her out with the other cattle. She ran after them and tried to hook them. She foamed at the mouth. We put her in the barn again and let her out the next morning, but again she ran after the other cattle and tried to hook them. She did not seem to feel it when she was whipped, and she would not try to hurt a person. Her eyes were a dark red. She shivered a good deal. She did not try to eat or drink anything for six days. After being almost dying for 24 hours, I killed her on the 15th. I have no more animals that are sick or that I know of being bitten. My neighbor has a dog that was supposed to have been bitten the same night that my dog was bitten, but he is running around and not stick.

Mr. M. W., of this place has just told me the following:

One day this summer a dog came to his place and jumped into the hog pen and bit two hogs badly, and one slightly. The two that were bitten badly got sick some time afterward and he killed them. The one that just got a scratch is still all right. When the dog left the hog pen he ran after a calf and bit it. The calf got sick some time afterward and foamed at the mouth. Mr. W. killed the calf. After the dog left Mr. W.'s. farm it ran on and bit several dogs along the way. It was killed at last and I understand that several dogs that this dog bit have also been killed.

Mr. H. W., of this place, says that one day this summer, a crazy dog came running and bit his dog in the nose and then ran on. Mr. W. killed his dog at once. Mr. P. N., address Smith Lake, Minn., says that one day this summer a mad dog came running and bit his two dogs. One of these got sick 17 days afterward and ran away and he has not seen him since. The other dog was not affected.

(Signed) J. L.

Outbreak 86—*Comfrey, Brown Co.* (*Cows*).—Under date of Oct. 20, 1902, Mr. O. T., of Comfrey, Brown Co., wrote to this Board a letter of which the following is an abstract:

"I have had three cows die of late. The first thing noticed is that they act mad and chase the other cattle in the yard for a day or so. After that they will lie down and get up frequently for two or three hours. After that they cannot get up any more. They then lie and kick for 15 or 18 hours and then die. The two first that died, died on the same day. After that I did not notice anything for about five weeks, when a third one died. Her bowels moved freely."

Mr. T. was asked to report by telephone or telegraph should any other of his animals become sick, that an investigation might be made. Under date of Nov. 1, 1902, he again wrote that no more of his cattle had become sick and that he should report if any did.

Outbreak 87—*Litchfield, Meeker Co.* (*Man, Horse*)—*Lab. No.* 81. —Oct. 4, 1902, there was received in the laboratory, the brain and medulla of a horse, from Litchfield, Minn. Accompanying the specimen was the following letter:

Dr. H. C. Peters, V. S. of Litchfield, Minn., sent you to-day the brain and medulla of a horse which was supposed to have died of rabies. This horse, after having been ill for about 24 hours, bit and severely injured a young man who had him in charge. The horse died in about two hours after the accident, after biting wagons, fences, posts and everything within its reach, as well as breaking his teeth by biting stones in the barn yard. Dr. Peters is of the opinion that the horse died of rabies. Please make the necessary inoculations to establish diagnosis. I have the young man in a hospital here and am very anxious to know whether the diagnosis of rabies is correct or not.

(Signed) JAS. W. ROBERTSON, M. D.

Dr. Robertson was advised immediately that it would be safer to send the patient to the Pasteur Institute without delaying to determine the results of rabbit inoculations.

Under date of Nov. 8, 1902, Dr. Robertson supplied the following additional information: "The horse that died was on a farm about one mile south of Grove City in Meeker Co. The young man's name was E. E. After he left me he became a patient of Dr. E. Boeckmann, of St. Paul. I do not know whether he was sent to Chicago or not. My advice was to send him at once, but they would not have it that way."

Accompaying the specimen from the horse was also the following letter from Dr. H. C. Peters, V. S., Litchfield, Minn.:

I am sending you to-day part of the brain and medulla of a horse. This horse died after showing symptoms corresponding quite closely with rabies, after having bitten its attendant. Dr. Robertson, the physician having the case in charge, wishes a positive diagnosis made as to whether it was rabies or not. The horse was noticed to be unwell sometime during the previous day, but did not attract any particular attention until night, when, as they describe it, he was very nervous and seemed to be frightened. He was sweating. In the evening they telephoned for me to come to see him. I saw him on the following morning. On going into the barn in the morning, I found the horse down. One young man went into the stall, and the animal grabbed him by the leg and would not let go for some time. It bruised and lacerated his leg quite a bit, and in trying to pull its jaws apart he cut his fingers on the horse's teeth. They finally got the horse up and turned him out. He then would bite at everything that came in his way, including fences and stones. The animal's incisor teeth were broken to some extent by this biting. During the night its appetite was good, since the manger was empty in the morning. It was about five o'clock in the morning when they turned the horse out of the stable. He was around the yard for a couple of hours, went out into the road once but came back, laid down and was dead in one half hour or so. He did not show any particular paralysis before he died.

On post-mortem, I could not see that the brain showed anything abnormal except a little congestion. There were a few small hæmorrhagic spots in the muscles all over the body, but particularly in the heart. The heart muscle was all darker than normal and had hæmorrhagic spots all through it. There were also petechial spots on the endocardium, and the heart muscle also seemed to be softened as if it had been cooked. You could push your finger into it any place with the greatest ease. The blood scarcely coagulated. It was very dark in color. A patch in the stomach was inflamed. The mucous membrane was thickened and red. Other than this I could see nothing abnormal. I had not seen the horse until after it was dead.

(Signed) H. C. PETERS.

Under date of Oct. 21, 1902, Dr. Peters supplied the following additional information:

I had not heard of any other cases of rabies in the vicinity of where the horse died until after the horse was dead. Since then, however, I have been told that a dog near this place died about four weeks before the horse did, showing some symptoms of rabies, such as biting at itself and other objects which came in its way. It lived three days after it got sick. When it died it was buried. I dug up this dog and found its stomach to contain a lot of hair, straw and dirt. This would be indicative of rabies.

H. C. PETERS.

When the specimen from the horse was received in the laboratory, some decomposition had already set in since it was not packed in ice. From the cerebellum and medulla, a colon-like bacillus and a bacillus which produced a yellow growth on agar, were isolated. From an emulsion of the medulla, rabbits Nos. 613-614 were inoculated subdurally. These died after 18 and 12 days respectively, having shown symptoms of rabies. From rabbit No. 613, a second series, rabbits Nos. 620-621, were inoculated subdurally. These died after 14 and 18 days respectively, after exhibiting symptoms of rabies.

Nov. 5, 1902, Dr. N. Barsness, interne at Luther Hospital, St. Paul, Minn., telephoned that the young man who had been bitten by the horse noted above was then in Luther Hospital. Dr. Barsness stated that the wound was healing nicely and the patient making a good recovery. Dr. Barsness was told then and Dr. Boeckmann, who had the case in charge, on the following day, that the horse had certainly died of rabies. It was pointed out to Dr. Barsness on November 6th by telephone, that owing to the long time, one month, which had elapsed since the biting, there would be little use of the Pasteur treatment for the patient at that time, and that the likelihood of the patient developing rabies was minimized with the elapse of each day. Furthermore, that only 17 per cent of the people bitten by rabid animals developed rabies, and finally that with these facts in the possession of the Luther Hospital authorities the matter of deciding what to do depended entirely upon the personality of the person making the decision.

Outbreak 88—Silver Lake, McLeod Co. (Child).—The first information concerning an outbreak of rabies in Silver Lake, Minn., received by this Board, was contained in the following letter:

Silver Lake, Minn., Oct. 26, 1902.

The dreadful disease, hydrophobia, has manifested itself in this community. From its effects, a whole family (Mr. J. W., his wife and three children) are in Chicago receiving the Pasteur treatment. Another case, a girl 14 years old, whom I was called to see to-day, is in the maniacal (excitement) stage and will probably die within 36 to 72 hours. Several dogs that were running at large supposed to be suffering from rabies, were shot. I have heard of others that seem to act strangely. Of course, I advised their immediate destruction. I am afraid of gravest consequences yet to come, and therefore hasten to ask you what steps should be taken to eradicate the disease. Please state what local quarantine on dogs can be enforced. It occurs to me that all dogs should be either muzzled or tied and that those that run at large, after due notice to their respective owners, should be shot. Kindly advise me.

T. W. HOVORKA, M. D., H. O.

The Veterinary Department of the Board was also notified of the disease in the following letter:

> Hutchinson, Minn., Oct. 28, 1902.
>
> Dear Doctor: A few miles from here they evidently have rabies. One man had a horse die showing symptoms of that disease. They called me up by 'phone but I was away at the time. The horse was bitten by a dog which the same day bit a girl slightly. The dog was killed. The party came here after the horse died. The doctors here advised him to go to Chicago with the girl and take the Pasteur treatment. He had been at work on the horse with sore hands. I understand that six of the people went to Chicago. They have another horse which is being carefully guarded. Dr. Sheppard, of this place, was called to see a girl yesterday in the same locality. He tells me that it was a pure case of rabies. The girl died. Another party had some hogs bitten. Dr. Sheppard asked me to write you for information as to what to do in regard to the animals bitten. The man that had the hogs bitten has sold some of them and does not know which hogs were bitten.
>
> H. C. LYON, V. S.

Drs. Hovorka and Lyon were immediately communicated with, suggestions were given concerning quarantine, etc., of the bitten animals. No further information was received from either of them.

The Common Council of the Village of Silver Lake, published an order that all dogs should be locked up, chained or muzzled, and that all dogs running at large, unmuzzled, for a period of 60 days after Oct. 28, 1902, should be shot.

Outbreak 89—*Osseo, Hennepin Co.* (*Calves*)—*Lab. No.* 82.—Saturday, Nov. 1st, 1902, Mr. A. Zimmerman, chairman, Board of Supervisors and Mr. D., of Osseo, Minn., brought to the laboratory the head of a calf. Dr. C. C. Lyford, of Minneapolis, telephoned in the morning that Mr. D. had consulted him concerning the calf which had died Oct. 23, 1902. Mrs. D. had been feeding this calf while it was sick, and Mr. D. was fearful lest the calf had died of rabies. That the saliva from the calf had covered Mrs. D.'s hand, on which there may have been a fresh cut or tear. Accordingly he dug up the calf after it had been buried and brought the head to Dr. Lyford, who sent him with it to the laboratory. The head was much decomposed when received.

From the medulla, two rabbits, Nos. 618-619, were inoculated. These died after 19 and 22 days respectively. From the medulla of rabbit No. 618, a second pair of rabbits were inoculated, Nos. 626-627. Rabbit No. 626 died 39 days after it was inoculated. Rabbit No. 627 remained alive and well during the ensuing four months, after which time it was used for another purpose.

Outbreak 90—*Bear Lake, McLeod Co.* (*Dog*).—The only information concerning these cases received by this Board was contained in the following letter:

Bear Lake, Minn.

Dear Sir: There is a case of hydrophobia in this town at P. F. M.'s. A strange dog bit some of his hogs. Two of the hogs died. He shot and killed the dog. This was in the month of November (1902).

(Signed) E. WILLIAMS, Town Clerk.

Outbreak 91—*Clear Lake, Sherburn Co.* (*Child, Dog*)—*Lab. No.* 83.—Nov. 17, 1902, there was received in the laboratory a portion of the spinal cord and medulla of a dog. The specimen had been sent by Dr. E. A. Woods, of Clear Lake, Minn., to the Secretary of this Board and forwarded by him to the laboratory. Accompanying the specimen was the following letter:

Clear Lake, Nov. 13, 1902.

I am sending a specimen of the upper end of the spinal cord and medulla of a dog that is supposed to have had rabies. The history is as follows: A strange dog bit a boy, 17 years old, in the cheek, making an ugly wound; also in the upper eyelid, tearing the tarsal cartilage into two pieces. The nose was scratched just deep enough for bleeding. I dressed the wound and cauterized it the best I could. I redressed it this morning and it is doing nicely. This dog bit two other dogs and then ran on towards the Mississippi river. It then turned south until nearly opposite Becker. It was followed by a number of armed men and shot at this point. I am told that he bit at everything in his path. The dog was brought to the town and I have opened the head at the base of the skull and send you the specimen removed. I ordered the two dogs that were bitten chained up. Please telegraph the report of this specimen, and if positive, I will send the boy to the Pasteur Institute.

(Signed) E. A. WOODS, M. D.

Two days before the specimen was received the above letter from Dr. Woods arrived.

Dr. Woods was written to immediately, *i. e.* Nov. 15, 1902, by the Director of the laboratory, as follows:

Dear Doctor: Your letter of Nov 13th has just been forwarded to me by Dr. Bracken, to whom it was addressed. The specimen of the dog's head mentioned therein has not yet been received. From what you say I infer that the specimen is from the dog which bit the boy—age 17 years—in the upper eyelid and cheek. If the history as you give it be substantiated by closer inquiry by yourself, it would seem to point to a diagnosis of rabies. It would be impossible for us to give an opinion on the specimen forwarded, for at least two weeks, and perhaps longer. Under these circumstances, it will be dangerous for you to wait until a laboratory opinion is given, because if it is advisable for the patient to receive the Pasteur treatment, he should receive it at once. The Chicago address, is, I believe, Dr. Lagorio, Pasteur Institute, 228 Dearborn St., Chicago, Ill. There are other Pasteur Institutes in Baltimore and New York whose addresses I could give you, though you asked only for the Chicago one.

Upon receipt of the specimen in the laboratory, Nov. 17, 1902, Dr. Woods was again written to by the Director of the laboratory, as follows:

Minneapolis, Minn., Nov. 17, 1902.

Dear Doctor: The specimen of dog's brain mentioned in yours of Nov. 13th and forwarded by you on Nov. 12th to Dr. Bracken, was received this morning in the laboratory by mail. The specimen was putrid on its arrival and consisted of a small amount of brain substance in the bottom of a wide mouthed bottle, of which the cork was paraffined. On removing the string from the neck of the bottle, the cork was forced out by the accumulation of gas due to putrefaction. I scarcely think we shall be able to give an opinion on this case at all, as it is extremely likely that the rabbits inoculated will die from septic meningitis before symptoms of rabies have time to develop. We are, however, making the inoculations, having entered the case on our record as rabies case No. 83, and shall let you know as soon as we are in a position to report at all.

From the material noted above, rabbits Nos. 624-625 were inoculated subdurally. These died after 11 and 5 days respectively, having shown symptoms of meningitis. At autopsy, both animals showed intense meningitis. One rabbit, No. 625, showed an area of yellowish pus, subdurally, at the site of inoculation. Cultures from both rabbits showed *B. coli communis* in abundance.

Dr. Woods was informed of the results of the inoculations on November 28th, the date of death of rabbit No. 624.

In reply, under date of Nov. 30, 1902, Dr. Woods wrote as follows:

Little is known of the first dog concerned in this case of rabies more than the biting of a boy, and three other dogs. The case is now a clear one of rabies, because one of the dogs was preserved, chained up and fenced in. He developed a disease undoubtedly rabies. When this dog came down with rabies, the boy had received eight days' treatment by Dr. Lagorio in the Pasteur Institute in Chicago and the next morning, I received a telegram from Dr. Lagorio stating that the boy had developed hydrophobia. I at once sent the father to Chicago and have received word from him by telegraph that the boy has died. The boy was only sick two and one-half days. Since then I have received a letter from Dr. Lagorio stating that the bites were in a very dangerous location and very severe.

To go back to the morning that the case began. The boy was bitten at six o'clock in the morning. He immediately took after the dog with his gun, running and stimulating his circulation. He came into my office near noon. I cauterized the would immediately with permanganate of potassium and put in seven stitches. I then began my work of investigating the dog, which I opened and sent a part of to the laboratory through Dr. Bracken. I waited for your report before sending the boy to Chicago and when your first letter of Nov. 15th came, I found you had received the letter, but not the specimen. The next day another letter from you stated the condition of the specimen and that it would probably take two weeks to get the results required unless septic meningitis developed in the meantime, as it has. When I learned the length of time required, I sent the boy at once to Chicago. It may be that had I sent the boy to Chicago the afternoon of the day he was bitten, that Dr. Lagorio could have saved him, but with a case like that where there is quite a little expense to the father, he and the rest of the family wanted to know if the dog was mad, and of course, we could not tell him positively at once. Another time, I shall insist on Pasteur treatment immediately. The dogs of this village have been ordered muzzled or tied up, and any strange dogs traveling through here are liable to be shot. This holds good until Feb. 1, 1902.

(Signed) E. A. WOODS, M. D.

In a note on a formal report blank, Dr. Woods gives the following additional information: "Besides the boy, the dog was known to have bitten three dogs. These three dogs were tied up and fenced in to be watched. The owners of two of them shot their dogs before symptoms appeared of any sickness. The third dog developed sickness after 15 days' incubation and showed all the typical symptoms of rabies in the dog."

In relation to this outbreak, the following letter from the chairman of the town board of Becker, near which place the dog that bit the boy was killed, is herewith presented:

Becker, Minn., Dec. 4, 1902.

The mad dog which bit the young man in Clear Lake, Minn., came to Becker, and bit two other dogs, both of which went mad. The owners of the dogs did not tie or muzzle their dogs and one of them bit a boy but did not bring blood. He also, bit the tails of two cattle. The cattle were bitten about five o'clock in the afternoon. Next morning, the owner of the cattle cut off their tails. Would that save them? After biting the cattle, the dog was seen about two miles from home on the same afternoon where he bit three more dogs that we know of. These were killed. Several other dogs that we know of were also bitten.

On Nov. 29, 1902, two cattle went mad. These were probably bitten by the dog which bit the boy. The board of supervisors put up a notice that until further notice any dog found running at large and not properly muzzled would be killed.

(Signed) IRVINE S. WAGNER, Chairman, Town Board.

Dec. 8, 1902, Mr. E. F. Carlin, chairman of the Board of Supervisors of the town of Palmer, Sherburn Co., reported to this Board as follows:

"There is a mad dog scare in this town on account of several cases in the adjoining town of Clear Lake. One case, a steer, has gone mad in this town. Has the town board power to compel all dogs to be muzzled or tied up?"

Outbreak 92—*Middleville Twp., Wright Co.* (*Cattle*)—*Lab. No.* 84 and 84a.—Nov. 24, 1902, Dr. Brimhall went to the farm of Mr. B., Middleville Twp., Wright Co., to investigate an outbreak of obscure disease in cattle. Six cattle had died in the vicinity in the two weeks immediately preceding Dr. Brimhall's visit, all apparently of the same disease. Of these, Mr. B. had lost three, one neighbor two, and another, one. A rabid dog had been through the neighborhood about a month before and was known to have bitten some of the animals, but not all of them.

One cow, the property of Mr. B. had died just before Dr. Brimhall's arrival, and another was in the last stages of the disease. From the description given by those who had attended the animals, and from the symptoms of the dying animal, a provisional diagnosis of rabies was made.

Dr. Brimhall collected milk from the cow which was sick, and made an autopsy on the animal which had recently died. There were apparently no gross lesions except congestion of the meninges.

A portion of the spinal cord of this cow was brought to the laboratory. From this spinal cord, rabbits Nos. 628-629 were inoculated. Rabbit No. 628 died after twenty-seven days. Rabbit No. 629 died in eighty days. No bacteria were recovered in cultures from the original material or either of the rabbits.

Though but one pair of rabbits was inoculated from this case, and though death in one of these was delayed for a period of eighty days, yet the laboratory examination would seem to bear out the clinical diagnosis of rabies.

The milk from the second cow (see above) was inoculated subdurally into rabbits Nos. 630-631. These showed no symptoms during the ensuing three and one-half months, after which time they were used for another purpose.

Outbreak 93—*Willmar, Kandiyohi Co.* (*Dog, Cattle, Horse*).—The first information concerning this outbreak was received by the secretary of the board in the following letter:

Willmar, Minn., Oct. 22, 1902.

Dr. Bracken: Last Friday I was called to Mr. E.'s., section 25, West Lake Lillian. The farmer (Mr. E.) told me that his dog, about five weeks ago, acted strangely, tearing around the barn yard and biting at cows' and horses' heels and chasing them. He went to two of the neighbors and bit their dogs. He disappeared after that and they have not seen him for four weeks. The neighbors killed their dogs that he had bitten. One of Mr. E's. cows took sick about Oct. 12, i. e. four weeks after being bitten. The cow acted like the dog, chasing the young stock around, hooking them and bellowing. She had not eaten anything in three days. When I saw her she was tied up in a stall. She moaned constantly. She had not been up for two days. About the third day, the cow commenced to lose all power in its hind extremities. She died the next day after I saw her. I told him to burn her and burn all straw in the manger and close it up.

Mr. E. telephoned me to-day that another cow had taken down like the first one and wanted to know what to do. He said if she was not better to-morrow, Thursday, he was going to kill her. I was suspicious of rabies, but it may be meningitis. Mr. E. will call me up in the morning. What shall I tell him to do? Should we remove the head and send it down for examination or had you better send someone out there. I had him tie up the cow in a stall by itself.

(Signed) J. M. RAINS, M. D.

Dr. Bracken replied to Dr. Rains saying that both veterinarians were in the field on other work at the time, and that consequently it would be impossible to send any one from the department to make the examination. Dr. Rains was asked to send in a specimen and advised as to quarantine measures, etc.

Nothing further was heard from Dr. Rains until under date of Dec. 4, 1902, the following note was received:

I enclose a clipping from the Willmar Republican Gazette, of Dec. 4th. You will remember that I wrote to you Oct. 22nd about a farmer by the name of E. who at that time had lost three head of cattle. I had heard nothing about the cases until I read this item in the paper yesterday.

(Signed) J. M. RAINS.

The clipping referred to was as follows:

Veterinary Surgeon Ilstrup, of this city, was last week called to Lake Lillian town to treat a horse which had been acting strangely for some time, and found the animal had been suffering from rabies and that two dogs and three cattle had also died of the same disease. The horse became so vicious that it would allow no one to care for it, and when the hired man at the farm of the owner, Mr. W. L. went in the stall to feed it a day or two ago he was bitten on the arm. The animal drew blood on his arm but the man does not believe the teeth touched his flesh as he wore a heavy sweater. It reduced the stall to fragments and finally a veterinary surgeon was called.

When Dr. Ilstrup arrived, he found the animal dead, but the symptoms from which it died left no doubt that it had been afflicted with rabies. The animal had been turned loose in the yard and it had bitten several other dogs and cattle.

Mr. E., another farmer in the same town, who lost three head of cattle from rabies some time ago, is a neighbor of Mr. W. L., who owned the horse. Mr. E.'s. dog bit his cattle which died, and the disease in the horse is believed also to have its origin with this dog.

Mr. Frederick Linn, C. B. S., of Lake Lillian, was sent a copy of the above clipping and asked to furnish any additional information. In addition to the facts noted above, he said: "After they got the horse tied up, he began biting at his own legs and the manger. The horse was bitten by Mr. M. E.'s dog of Lake Lillian. I understand that there have been twelve or fifteen dogs killed in that neighborhood (Lake Lillian) that have shown sickness since the first case."

Mr. Olaf Wallin, Svea, Minn., chairman of the town of Rosebud, also made a formal report of a case of rabies in a horse, the property of W. L. In addition to the facts noted above, Mr. Wallin says: "The horse bit at some other horses, but Mr. L. does not know if it was enough to hurt any of them." Concerning the animal which bit the horse, Mr. Wallin says: "It was a dog which came over to Mr. L.'s place in October. The dog was unknown. No one knows where he came from or what became of him. This dog also bit a small dog belonging to Mr. L., and the small dog bit one of Mr. L.'s little boys. The small dog was killed when he bit the boy."

As a sequel to the above cases, Dr. Rains reported, under date of Feb. 16, 1903, another case as follows:

"Mr. B. E. B., section 33, Lake Elizabeth, was in to see me today about a mad dog that came to his place yesterday and bit a sheep, a lamb and also some calves before they could shoot him. The dog belonged to his neighbor, Mr. I. W. According to his story, the disease is in both East and West Lake Lillian townships and also in Lake Elizabeth."

Mr. O. C. Peterson, C. B. S., of Lake Elizabeth, was asked to give further information concerning this dog, and under date of March 10, 1903, reported as follows:

I have been investigating our town and find that all the dogs that were affected with rabies were killed so far as I know.

(Signed) C. O. PETERSON,
Atwater, Minn.

In addition to the above, the following report was received March 16, 1903:

Willmar, Minn., March 14, 1903.

I hereby report to you that on the 6th of March, I had a dog killed with symptoms of hydrophobia. The owner's name and address, Miss F. L., Willmar, Minn. On March 8th, I saw a horse with symptoms of hydrophobia, and the owner reported on the 9th, that he had killed it as it had become unmanageable. The owner's name and address was N. T., town of Fahlun, Willmar, Minn.

(Signed) NELS TRUELSON,
Fahlun Twp., Kandiyohi Co., Minn.

Outbreak 94—*Herman, Grant Co.* (*Dog*)—*Lab. No.* 85.—Jan. 5, 1903, there was received in the laboratory a specimen of spinal cord of a dog from Herman, Minn. Concerning the specimen the following postal card was received:

Herman, Minn., Jan. 2, 1903.

I send you to-day, a specimen of spinal cord of a dog suspected of rabies, which you will greatly oblige me by examining and making a report at your earliest convenience.

(Signed) G. E. McCANN, M. D.

In reply to a request for further information, Dr. McCann furnished the following facts on a formal report blank:

"The dog was the property of Mr. A. A. of Herman, Minn. On Dec. 28, 1902, it was taken with a convulsive attack and started through the streets, biting and snapping at everything in reach. It bit several dogs and one child. It was shot within about two hours after it showed symptoms."

Immediately upon the receipt of the circular containing the above data, the director of the laboratory wrote Dr. McCann as follows:

"As I said in my letter of January 6th, it will be unsafe to await the results of the laboratory findings before Pasteur treatment is given, if that seems indicated. Such a matter should be attended to on the basis of clinical findings. If you have reason to believe that this dog was rabid, it would have been the safe thing to do to have the child treated. That was why I mentioned the matter immediately upon writing to you on January 6th."

It will be seen from the above that eight days had elapsed between the time when the dog was shot, Dec. 28, 1902, and the time when it was received in the laboratory, Jan. 5, 1903.

When received the specimen was in a small glass-stoppered bottle without ice packing. Cultures from the material showed a white staphylococcus and a large putrefactive bacillus. Rabbits Nos. 652-653 were inoculated subdurally with an emulsion of the cord and died in 22 and 19 days respectively, after exhibiting symptoms of rabies. From the medulla of rabbit No. 653 a second series of rabbits were inoculated, Nos. 662-663. These died after 20 and 33 days respectively, having shown symptoms of rabies.

Immediately upon the death of the last animal, Jan. 28, 1903, Dr. McCann was informed of the positive diagnosis of rabies in the case. In reply Dr. McCann wrote as follows, under date of Jan. 31, 1903:

"Some one-half dozen dogs that were bitten by the dog from which you received the specimen Jan. 2, 1903, have been afflicted with the same disease, namely, rabies. The children who were bitten have shown no signs of the disease and were taken to Chicago for treatment yesterday. I agree with you in saying that they would not be likely to suffer any ill effects after so long a time, especially as the wound received prompt attention. I was unaware that more than one child had been bitten until yesterday. Of course, the danger of their being affected is small, but we thought it best not to take any chances. The most stringent measures have been taken to stamp out the disease, and I think it is pretty well under control."

Outbreak 95—*Clara City, Chippewa Co.* (*Dog*)—*Lab. No.* 86.—Jan. 14, 1903, there was received in the laboratory the head of a dog from Dr. A. A. Rankin, of Clara City, Minn. Accompanying the specimen was the following letter from Dr. Rankin:

Clara City, Jan. 12, 1903.

Dear Doctor: I am sending you by express the head of a large dog, suspected of rabies. The dog was killed before I could prevent it, by a mob of men and boys, who may have shot up the head badly. Saturday, Jan. 10th, this dog came to town. He was trotting around town all that day, snapping at every dog that came within reach and biting at sticks, etc., thrown at him. He did not snap at any people so far as has been reported. He would not run even when chased or shot at, but traveled at a slow trot or walk all the time. He seemed to go around the town and come back to the same spots again and again. The owner is unknown, though he is thought to be a farmer, six miles out of town, Mr. M. B., in the town of Lone Tree. It is stated that Mr. B's. dog was bitten by another suspected dog last summer. The particulars, however, are very vague.

All the dogs in town have been shut up, muzzled or shot on order of the city council.

The head of the above mentioned dog when received in the laboratory was in good condition.

From the medulla, rabbits Nos. 659-660 were inoculated subdurally. They both died in nineteen days after exhibiting symptoms of rabies. A positive dagnosis of rabies was made on the findings in these two rabbits.

Outbreak 96—*Grey Eagle,Todd Co.* (*Cow, Swine*)—*Lab. Nos.* 87-88. Feb. 20, 1903, there was received in the laboratory the heads of one cow and three hogs. Acompanying the specimens was the following letter:

> I am sending to-day some heads of animals for examination. They are supposed to have rabies. All were bitten by a dog that gave all the symptoms of rabies. He went through the northern part of this township and bit eleven hogs, one cow and two or three other dogs, All animals died the typical death with the exception of three hogs, which I ordered killed yesterday. These three were sick. I have posted notices in the neighborhood to muzzle or confine all dogs, but as it is four or five miles from this village, I do not think such an order is necessary in the village. Do you? I might say that the dog that did the dirty work, is dead.
>
> (Signed) R. P. STOREY, M. D.

From the medulla of the cow noted in the above letter, rabbits Nos. 677-678 were inoculated subdurally. These died after 21 and 18 days, respectively, having exhibited symptoms of rabies. From the medulla of rabbit No. 678, a second pair of rabbits, No. 712-713, were inoculated. Rabbit No. 712 exhibited no symptoms to date, an interval of three months. Rabbit No. 713 died after 42 days.

From the medulla of one of the hogs noted in the original letter, rabbits Nos. 679-680 were inoculated. Rabbit No. 679 died three days after inoculation. Rabbit No. 680 lived four months.

Though the results of the laboratory examination in the above cases was somewhat unsatisfactory, yet a diagnosis of rabies in case 87 (cow) would seem to be warranted.

Outbreak (?) 97—*Belle Plaine, Scott Co.* (*Cat*)—*Lab. No.* 89.—Feb. 25, 1903, there was received in the laboratory the body of a large ring-streaked cat from Dr. G. R. Moloney, of Belle Plaine, Minn. Concerning the specimen the following letter was received from Dr. Moloney:

> Belle Plaine, Minn., Feb. 24, 1903.
>
> I send you by this afternoon express a dead cat that on last Sunday, Feb. 22nd, bit two children, of the ages of 12 and 7, cutting them slightly, and drawing a little blood. This cat did not belong to the house where the chil-

dren lived. It came to the house three months ago. The people did not know from what place. As the children were passing it in the yard, the cat jumped from under a sleigh and bit one of them on the hand. The other child took up a stick and the cat then bit him. The parents of the children are fearful lest the cat may have been in a mad condition. It was not noticed to be sick at any time and there have been no cases of rabies in the neighborhood, so far as we know. The cat is supposed to have been the property of Mr. J. N., of Belle Plaine. It was in the habit of going into the woods in the summer time.

(Signed) G. R. MOLONEY.

On removing the medulla and base of the brain of the cat mentioned in the above letter from Dr. Moloney, much blood was found about the meninges, though it was impossible to determine whether this was ante-mortem since the cat had been shot or struck over the head.

The material from the medulla was used for inoculating broth and serum cultures. After 24 hours in the incubator there developed an apparently pure culture of a large diplococcus in the broth. On the serum on which a heavy sowing had been made, 12 colonies of diplococci giving a similar appearance developed. Subsequent cultures from all of these on various media gave all of the cultural characteristics of *diplococcus pneumoniæ.*

Material from the medulla was used for inoculating rabbits Nos. 681-682 subdurally. These rabbits have shown no symptoms to date (after three months).

It would therefore appear (1) that the case was not rabies, and (2) that it may have been meningitis due to *diplococcus pneumoniæ*, though the history of clinical symptoms, the crushed condition of the brain of the animal, together with the possibility of contamination of the material, would make such a diagnosis from the bacteriological examination alone somewhat doubtful.

Outbreak 98—*Freeport, Millwood Twp., Stearns Co.* (*Swine*).—The only information concerning the above cases received by this board was in the form of the following notification:

Feb. 24, 1903.

Our chairman had such a troublesome disease in his case that immediate killing was necessary. We are near Todd Co., Grey Eagle Twp., where some hogs and some other animals were infected, and physicians declared necessary the killing of the hogs, so we entered his premises and killed his two hogs which were infected with rabies. See the accompanying statement.

(Signed) ANTON WILMERDING.

Accompanying the above letter was also a formal statement from Mr. Wilmerding, stating that the board of health of Millwood

Township had entered the premises of the owner of two hogs suffering from rabies and killed them for the safety of the general health. The value of the hogs was appraised at $10 each. The owner hoped to recover their value from the state.

Outbreak 99—*Clinton, Bigstone Co.* (*Dog*).—The only information at hand concerning this case is contained in the following letter:

Clinton, Minn., Feb. 27, 1903.

Given a case of a pet dog, a cross between a pug and Scotch terrier, bitten about 18 days prior to the first symptoms, by an Irish setter, inclined to bite all dogs and later dying on account of some trouble, most manifest in the throat, as expressed by the owner of the setter.

The first symptoms manifested by the pet dog were disinclination to take food or drink, a slow irregular pulse, constipation, dropping of lower lip, gradually increasing to opening of mouth, protruding tongue, labored breathing increasing day by day. The third or fourth day of illness, some cough, each time usually followed by vomit looking as though it had been mixed with some black coloring matter. Up to the fifth day there was absolute aversion to water. When left alone on the fourth day, the animal would sit up in his nest and snap at supposed imaginary objects, as though he were snapping at flies. On the morning of the fifth day, he commenced to drink water copiously. There was no more snapping at imaginary objects. The gait was staggering, the breathing very labored and there was occasionally black vomit. The animal would bite at his head occasionally. It was evident that the dog could not recover and he was killed. Could you give a diagnosis of the disease?

Other dogs that were bitten acted strangely at about the same time. One or two died and others were killed. Most of them developed a tendency to snap at other dogs. Have not heard of any of them trying to bite other stock or people except in two instances. Here the attempts were unsuccessful.

Thinking perhaps there may be an element of rabies in the epidemic, the village board of health has ordered all dogs confined or muzzled for 20 days. We shall be glad to hear of your opinion in the case of the pet dog.

(Signed) S. C. BOROM, M. D.

From the description in the above letter, Dr. Brimhall felt warranted in giving a diagnosis of rabies.

Outbreak 100—*Alden, Freeborn Co.* (*Dogs*)—*Lab. Nos.* 90-92.—March 4, 1903, there was received in the laboratory from Dr. Robert Williams, Alden, Minn., a two-ounce bottle containing about a drachm of bloody fluid. Accompanying the specimen was the following letter:

"Enclosed is a specimen of saliva taken from a dog showing symptoms of hydrophobia. There was no frothing at the mouth nor any definite symptoms except that he acted strangely, snapping at other dogs and seemed somewhat blind. He was shot before any chance was allowed for observing him. No person was bitten, but perhaps some other dogs were. Let us have a telegraphic report if any positive diagnosis is made, so that we may take ample precautions."

In addition to the above information, Dr. Williams later wrote "that the owner of the dog was unknown, and that four other dogs were known to have been bitten by this one, which was killed two hours after it first appeared in the town."

From the fluid (saliva) mentioned above, direct coverslip preparations stained with eosin and methylene blue showed large and small bacilli and staphylococci. Cultures in broth and on serum showed a white staphylococcus, colon bacillus and a very small, non-motile bacillus which grew with a fine growth on all solid media, did not coagulate milk or form acid or gas. In addition there was also a larger, non-motile, evenly-staining bacillus which formed a slight pellicle in broth, did not form acid or gas and grew with a moist, yellow growth on serum and agar.

From the original fluid (saliva) rabbits Nos. 699-700 were inoculated subdurally with 0.2 c. c. each. Rabbit No. 699 died in less than 24 hours. An autopsy on this rabbit showed intense meningitis, while cultures and direct coverslip preparations showed the presence of *B. coli communis*. Rabbit No. 700 died after 72 hours. An autopsy showed meningitis as in rabbit No. 699, while cultures from the meninges showed also the presence of *B. coli communis*. Since the symptoms in this rabbit resembled somewhat those of rabies, two other rabbits, Nos. 706-707, were inoculated subdurally with a portion of the medulla of rabbit No. 700. One of these, rabbit No. 706, is still alive after three months, having shown no symptoms in the meantime. The other rabbit, No. 707, died on the seventh day after inoculation. The meninges at autopsy were found to be congested.

Guinea pig No. 564 was inoculated subcutaneously in the right groin with 1 c. c. of the original material (saliva) from the dog. The animal remained alive and well for two months and then died of pneumonia.

Under date of March 6, 1903, Dr. Williams wrote as follows:

"I regret that I cannot send the brain of the dog, as it was buried in a low place and is covered with mud and water. I am in hopes that you can do something with the material (saliva) already sent. I have considerable doubt about the dog being mad, but wish to protect the community."

March 13, 1903, there was received in the laboratory from Dr. Williams the head of a large black and yellow mongrel dog. Accompanying the specimen was the following letter from Dr. Williams:

> The supposed mad dog, head contained within, was shot March 10th, after acting queerly. It had bitten several cattle and horses and a few dogs. All of these dogs have been killed. This dog was bitten by the dog whose saliva I sent you March 3rd. No very definite symptoms were manifest, but we are anxious to find out definitely in regard to the matter, as there is considerable alarm over it.
>
> (Signed) ROBT. WILLIAMS, M. D., H. O.

The specimen noted above was wrapped in oil cloth, packed in sawdust and soldered up tightly in a tin box which was enclosed in a wooden box.

On opening it in the laboratory the head seemed in good condition. The spinal column was sawed off near the base of the skull, the end of the cord flamed and a portion of the medulla removed with a sterile curette. An emulsion was made from this, and rabbits Nos. 715-716 were inoculated subdurally. Direct coverslip preparations from the original material showed no bacteria. The inoculation material showed a large bacillus which formed a heavy pellicle in broth, and gave a heavy, gray growth of all solid media.

Of the first pair of rabbits inoculated, rabbit No. 716 died after 19 days, having shown symptoms of rabies. From the medulla of this rabbit another pair, rabbits Nos. 739-740, were inoculated subdurally. These died after 20 and 15 days respectively, having shown symptoms of rabies.

It will thus be seen that a diagnosis of rabies was warranted in the laboratory findings in the second case, which would also make positive the diagnosis of rabies in the case of the first dog.

Outbreak 101—*Faribault, Rice Co.* (*Swine, Dog*)—*Lab. No.* 91.—March 9, 1903, there was received in the laboratory from Mr. R. J. L., of Faribault, Minn., the head of a large Poland-China pig. Accompanying the specimen was the following letter from Mr L.:

> Dear Sir: Some six weeks ago, a strange dog came around my farm and engaged in a fight with my dog. It was frightened away. Immediately afterward, it was killed, while engaged in running the hogs. Since then I have lost six animals at different times, and think they have come in contact with some contagious disease. Have been advised to ship you the head of one of the hogs. Kindly advise me as soon as you can, as to the cause of their death.
>
> (Signed) R. J. L.

Dr. D. M. Cool, H. O., of Faribault, Minn., was asked to supply further information concerning this case, and under date of March 24th wrote as follows:

"Replying to yours of recent date asking for information as to the number of hogs Mr. L. lost, Mr. L. has lost seven in all. I have made some inquiries regarding loss by other neighbors. It seems this dog was a tramp. At least he belonged to no one in the vicinity of Mr. L.'s farm. He was shot before he had time to get away. So far I cannot find that any one has lost any animals from this or any other dog. Some have shot their dogs on the supposition that this one bit them, thus not giving them time to develop the disease. There is a possibility that this dog or the hogs might have rabies. If I can get any further light on the matter, will address you concerning it."

In addition to the above letter, Dr. Cool furnished on a formal report blank the following data:

> The hogs were at first stupid and sleepy and inclined to lie still. One, however, was very ugly and would bite a stick and get much excited. They all made an effort to get up, but would fall down with spasmodic action of the limbs. All of them, most of the time, were apparently exhausted and weak. There was loss of appetite from the first. The first animal got sick about the first of February. I cannot give exact dates of the deaths.
>
> (Signed) D. M. COOL.

The head of the pig noted above when received in the laboratory was packed in a box in a large amount of sawdust and straw. There was no wrapping about it. The spinal column was sawed off near the base of the skull, the end of the spinal cord flamed and a portion of the medulla was removed with a sterile curette. Cultures from the material showed a white staphylococcus and *B. coli communis.* An emulsion was made of a portion of the medulla, and rabbits Nos. 709-710 were inoculated subdurally. These animals died after 21 and 17 days respectively, having exhibited symptoms of rabies. A diagnosis of rabies was therefore made.

Outbreak 102—*Cedar, Anoka Co.* (*Dog*).—April 9, 1903. The only information at hand concerning this case is contained in the following letter:

> There was a dog around here on Thursday of last week (April 2nd). He bit several dogs in this neighborhood. On Saturday morning (April 4th), I saw him coming along the road. I got my rifle and shot him, but our dog

started to fight him before I could kill him and I think he must have bitten our dog, as his left hind foot is swollen. Do you think it would be best to kill him or not? I have him chained up so that nothing can come near him. How long will he live if he goes mad? I do not want to kill him, as he is a valuable dog, but if he goes mad I will kill him.

(Signed) A. E. C.

Mr. C. was written to concerning the case, but nothing further has been heard from him. A diagnosis of rabies must remain in doubt in this instance.

History of the Disease in Minnesota—Very little is known concerning the date of the first appearance of rabies in Minnesota. The first cases actually observed of which any definite information can be obtained are those of Dr. Richard Price, V. S., St. Paul., who has given more clinical study to this disease in animals than any one else in Minnesota.

Dr. Price has very kindly afforded the following information:

"In 1885 or 1886, a valuable pointer belonging to Dr. V., of St. Paul, developed a well marked case of furious rabies. * * * *

"In 1888, an outbreak of hydrophobia appeared in a herd of cattle on a farm belonging to Mr. J. C., about 15 miles west of St. Paul. Twelve deaths from rabies resulted amongst these animals, which had been worried by a strange dog some three of four weeks previous to the development of the disease in the cattle.

"In 1895, a dog belonging to Dr. S—k, of St. Paul, developed furious rabies and bit a dog belonging to Dr. S—e, which in due time developed the disease. After the first dog bit the second dog, he ran a distance of 18 miles in three hours, and at the end of his journey bit three calves before he was killed.

"In the same year, at Newport, Minn., 37 animals developed rabies and died."

As bearing upon the history of rabies in Minnesota, the following extract from remarks made by Dr. Sweeney, in opening the discussion on rabies before the Minnesota Sanitary Conference, January 14th and 15th, 1902, may be quoted:

"I understood from Dr. Hewitt that in 1890 a brief outbreak in animals alone occurred, but in 1894, the first case was recognized in a human being, and from that time up to 1900 there have been occasional outcroppings. In the first case a dog bit three people, two of whom died from rabies, and the other was sent to the Pasteur institute and is still alive. In the third case, two years later, three children were bitten by the same dog. Two died, one was sent to the Pasteur institute and is still alive. The others were isolated cases. The diagnosis in four of these cases was settled by laboratory methods, by transmission of the disease to rabbits in varying series. In human beings in St. Paul there have been seven deaths. There have been a large number of cases of rabies in animals. Dr. Price, to whom we are all indebted for work relating to this disease, has estimated that probably 250 dogs have been proven to have rabies, both clinically and experimentally, during the past five years in St. Paul."

Table I. is a synopsis of the information concerning the outbreaks of rabies above reported in detail. In addition, certain data concerning Minnesota patients, afforded by the director of the Chicago Pasteur Institute since the preparation of the foregoing, are included. The Chicago report originally gave a list of 72 patients from Minnesota who were treated in Chicago during this time, and the names, addresses, dates, results of treatment and certain other collateral data were given. From this original list, 28 cases which received treatment in Chicago have been eliminated, since they are included in the 30 cases recorded in Table I. The remaining 44 cases treated in Chicago are listed immediately following Table I. Certain apparent discrepancies will be met with in comparing Table I. and its appended list of Chicago cases with the details noted under the individual outbreaks as having been afforded by the local authorities. These are due to the fact that the Chicago report contained records of a number of cases of which the Minnesota State Board of Health had no knowledge prior to the receipt of the report, *i. e.*, after the preceding portion of these investigations had been already printed.

TABLE I.—SHOWING OUTBREAKS OF RABIES IN MINNESOTA, 1896-1903.

No. of Outbreak	DATE	REPORTER.	TOWN.	COUNTY.	Men.		Horses.		Cattle.		Swine.		Sheep.		Goats.		Dogs.		Cats.		Laboratory Examination		
					Bitten	Took Pasteur Treatment	Bitten	Developed Rabies	Bitten	Developed Rabies	Bitten	Developed Rabies	Bitten	Developed Rabies	Bitten	Developed Rabies	Bitten	Developed Rabies	Bitten	Developed Rabies	Source of Material	Case Number	Diagnosis
1-39	Reported in Biennial Reports for 1895-1900. See table, Page 478 Biennial Report for 1899-1900.				10	7* 3†		2		19		8		7			Wolf	46 1					
39a	1900 Mar 12	Mr L H Hoyt, T C	Fridley	Anoka					?	65								1					
40	Reported in Biennial Report for 1899-1900. Page 465.		Good Thunder	Blue Earth						1											Cow	47	+
41			St. Paul	Ramsey														1			Dog	48	+
42			Bemidji	Beltrami								1									Hog	49	+
43			Tracy	Lyon														1			Dog	50	+
44			Minneapolis	Hennepin														1			Dog	51	+
45	1901 Jan 18	Dr. R. Price	St. Paul	Ramsey													3	3			Dog	52	+
46	Feb 28	Dr. L. Hay	Faribault	Rice							?	2					1	1			Hog	53	+
47?	Feb 28	Dr. M. H. Reynolds	St. Anthony Park	Ramsey																	Dog	54	—
48	Apr 15	Dr. L. A. Williams	Iona	Murray	1	1*			?		?						3	3			Dog	55	+
49	May 7	Dr. R. A. Campbell	Minneapolis	Hennepin	1	1†											1	1			Child	56	+
50?	May 17	H. G. Lytle, H. O.	South St. Paul	Dakota																	Dog	57	?
51?	May 20	Dr. J. G. Annand	Minneapolis	Hennepin													2	2					
52	June 8	Mr. A. H. F.	St. Paul Park	Dakota													?	2			Dog	58	+
53	Aug 13	Mr. Pomplun	New Canada	Ramsey													2	2					
53a	Aug 14	Dr. C. C. Lyford	Minneapolis	Hennepin			1	1													Horse	59	+
54	Aug 30	Dr. R. Price	St. Paul	Ramsey	1	1*											2	2			Dog	60	+
55?	Sept 27	Dr. C. C. Lyford	State Ex. Station	Ramsey																	Cow	61	—
56	Oct 21	Dr. F. M. Archibald	Harrison,	Kandiyohi	1	1§											1	1			Dog	62	+
57	Oct 29	Drs. Brimhall and Wilson	Taunton	Lyon					?	9							2	2			Cows	63,66	+
58	Nov 21	Dr. A. A. Keys	Bloomington	Hennepin	3	3*	?	1	?	2	?	1					?	3			Dog	64	+
59	Nov 26	Dr. R. Price	St. Paul	Ramsey	1	1*											?	2			Dog	65	+
60	Dec 8	Drs. Brimhall and Wilson	Anoka	Anoka					?	4	?	4					1	1			Cow	67	+
61	Dec 9	Dr. J. G. Annand	Minneapolis	Hennepin													1	1					
62	Dec 8	Mr. L. H. Hoyt	Fridley	Anoka					1	1							?	2			Dogs	68-69	+?
63	Dec 17	Mr. L. L. Leland, C. B. S.	Porter	Yellow Medicine					1	?							1	1					
64	Dec 26	Mr. J. L.	Merriam Park	Ramsey							?	1					?	1			Hog	70	+
65	1902 Feb 3	Dr. C. C. Lyford	Minneapolis	Hennepin					?	2							?	2			Cow	71	+
66	Feb 19	Dr. F. J. Bohland-Fuchs	Belle Plaine	Scott													4	4			Dog	72	+
67	Feb 26	Mr. L. H. Hoyt	Fridley	Anoka													4?	2					
68?	Mar 18	Dr. A. G. Moffatt, H. O.	Howard Lake	Wright																	Milk	73	—

TABLE I.—*Continued.*

No. of Outbreak.	DATE.	REPORTER.	TOWN.	COUNTY.	Men.		Horses.		Cattle.		Swine.		Sheep.		Goats.		Dogs.		Cats.		Laboratory Examination.		
					Bitten.	Took Pasteur Treatment.	Bitten.	Developed Rabies.	Bitten.	Developed Rabies.	Bitten.	Developed Rabies.	Bitten.	Developed Rabies.	Bitten.	Developed Rabies.	Bitten.	Developed Rabies.	Bitten.	Developed Rabies.	Source of Material.	Case Number.	Diagnosis.
69	Mar 14	Mr. E. J. Rice, T.C.	Oronoco	Olmstead					?	3	?	1					2	2			Dog	74	+
70	Mar 31	Dr. H. E. Conley, H. O.	Cannon Falls	Goodhue	1	1*											1	1			Dog	75	+
71	Apr 8	Dr. M. E. Bushey	Arlington	Sibley	5	3* 2§											1	1			Dog	76	+
72	Apr 17	Dr. J. G. Annand	Sand Creek	Scott					2	2	?	17			2	2	?	1					
73	Apr 24	Dr. W. S. Leach, H. O.	Brooten	Stearns													5	5					
74	May 28	Dr. E. E. Brubaker, H. O.	Northfield	Rice	1	1*a											3	3			Dog	77	+
75	June 2	Mr. H. A. W.	Clearwater	Wright					?	1	?	1					?	1					
76	May 24	Mr. E. S. Wiggins, C.B.S.	Rogers	Hennepin					?	8	?	39					?	4			Hog	78	+
77	July 4	Dr. H. I. Grivelly	Waconia	Carver	1	1*					1	1					2	2					
78	July 9	Dr. E. W. Cooley	Blooming Prairie	Steele	1	1*											1	1					
79	July 20	Dr. S. D. Brimhall	Annandale	Wright					1	1	7	7					6	6					
80	Aug 5	Drs. Brimhall & Wesbrook	Kiester	Faribault					3	3							1	1					
81	Aug 15	Mr. E. A. Hart, C. B. S.	Maple Lake	Wright					?	5							?	4					
82	Aug 14	Dr. J. G. Annand	Dexter	Mower					?	2							?	5			Cow	79	?
83	Aug 20	Mr. N. A. Fredricsen, C.B.S	New Market	Scott	2	1§ 1*a			?	6							?	2					
84	Aug 25	Dr. H. O. Smith	Shakopee	Scott													2	2			Dog	80	?
85	Oct 14	Dr. E. Y. Chilton	Granite Lake	Wright					?	2	?	4					6+	6+		1			
86	Oct 20	Mr. O. T.	Comfrey	Brown					?	3													
87	Oct 14	Dr. J. W. Robertson	Litchfield	Meeker	1	1§	?	1									?	1			Horse	81	+
88	Oct 26	Dr. T. W. Hovorka	Silver Lake	McLeod	7	1† 6*											?	3					
89	Nov 1	Dr. C. C. Lyford	Osseo	Hennepin					1	1							1	1			Calf	82	+
90	Nov 1	E. Williams, T. C.	Bear Lake	McLeod							2	2					1	1					
91	Nov 17	Dr. E. A. Woods	Becker Clear Lake Palmer	Sherburne	1	1*b			?	3							?	□ 9			Dog	83	+
92	Nov 24	Dr. S. D. Brimhall	Middleville	Wright						7							1	1			Cow Cow's Milk	84 84a	+ —
93	Oct 22	Dr. J. M. Rains, H.O.	Lake Lillian Lake Elizabeth Willmar Rosebud Fahlun	Kandiyohi	1?	1§	2	2	3	3			2	2			?	16					
94	1903 Jan 5	Dr. G. E. McCann	Hermann	Grant	2	2*											?	7			Dog	85	+
95	Jan 14	Dr. A. A. Rankin	Clara City	Chippewa													?	6+			Dog	86	+

96	Feb	20	Dr. R. P. Storey...	Grey Eagle......	Todd.......	.....	.....	.....	.....	1	1	11	11	.....	.....	.....	.....	4	4	.....	.. }	Cow Hog	87 88	+ ?
97?	Feb	24	Dr. G. R. Moloney	Belle Plaine......	Scott.......	(2)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(1)	Cat	89	—
98	Feb	24	Mr. A. Wilmerding	Freeport.........	Stearns.....	.....	.....	.....	.....	.....	.....	?	2	.....	.....	.....	.....	1	1	.....	.....	......	......	....
99	Feb	27	Dr. S. C. Borom....	Clinton...........	Bigstone...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	?	6+	.....	... {	Saliva	......	....
100	Mar	4	Dr. Robt. Williams.....	Alden...........	Freeborn...	.....	.....	?	.....	?	.....	.....	.....	.....	.....	.....	.....	?	6+	.....	... {	of Dog Dog	90 92	? +
101	Mar	9	Dr. D. M. Cool.....	Faribault........	Rice........	.....	.....	.....	.....	.....	.....	?	7	.....	.....	.....	.....	?	1	.....	.....	Hog	91	+
102?	Apr	9	Mr. A. E. C.........	Cedar............	Anoka......	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(1?)	.....	.....	......	......	....
			Total number of persons untreated except cauterization.		Died.............	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	......	......	....
					No Symptons...	.....	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	......	......	....
			Total number of persons received pasteur treatment....		Died.............	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	......	......	....
					No Symptons...	.....	29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	......	......	....
			Totals..			41	41	5+	5	154+	154	109+	109	2+	2	2	2	198+	198	.....	1	......	.....	....
104			Total number Cases of Rabies....................		478													Wolf	1					

* Treated. No symptoms.
*a. Treated but not included in Chicago report. No symptoms.
*b. Died—Treatment began late.
† Died of Rabies. Untreated.
§ Wounds thoroughly cauterized. No symptoms.

LIST OF PATIENTS FROM MINNESOTA TREATED IN PASTEUR INSTITUTES, CHICAGO, 1896-1903, AND NOT INCLUDED IN TABLE I.

1896.

1. J. H. S., 39 years, from Glenwood, Minn, bitten by dog January 17th.
2. W. W. F., 8 years, from Glenwood, Minn., bitten by dog February 22nd.
3. R. W., 37 years, St. Paul, Minn., bitten by dog March 10th.
4. F. M., 38 years, from Jordan, Minn., bitten by dog June 13th.
5. Mrs. S. J. K., 73 years, from Austin, Minn., bitten by dog June 4th.
6. A. R., age 45 years, from Heidelberg, Minn., bitten by shepherd dog December 14th. Two rabbits inoculated in laboratory, December 20th, died January 13th.
7. J. S., 16 years, from New Prague, Minn., bitten by same dog December 15th. These last two patients were sent by Dr. E. E. Novak of New Prague.

1897.

8. G. O., 8 years, from Maple Lake, Minn.. bitten by dog August 10.

1899.

9. E. H. A., 46 years, from Minneapolis, Minn., bitten by dog June 10th.
10. F. P., 43 years, from Minneapolis, Minn., bitten by dog June 9th.
11. H. L. D., 12 years, from Minneapolis, Minn., bitten by dog June 4th.
12. H. L. D., 9 years, from Minneapolis, Minn., bitten by dog June 9th.
13. H. N. C., 32 years, from Minneapolis, Minn., bitten by dog June 10th.
14. N. F. S., 29 years, from Minneapolis, Minn., bitten by dog June 10th.
15. H. C., 4 years, from Minneapolis, Minn., bitten by dog June 10th.
16. W. P., 14 years, from St. Paul, Minn., bitten by dog Sept. 8th.
17. A. J. G., 26 years, from St. Paul, Minn., bitten by dog Sept 8th.
18. J. D., 11 years, from St. Paul, Minn., bitten by dog Sept. 8th.
19. H. B., 44 years, from Minneapolis, Minn., bitten by dog Sept. 8th.
20. M. G., 38 years, from Robbinsdale, Minn., bitten by dog Sept. 8.
21. A. W., 13 years, from St. Paul, Minn., bitten by dog Sept 8th.

1900.

22. R. S., 13 years, from Minneapolis, Minn., bitten by dog March 25th.
23. F. H., 17 years, from Minneapolis, Minn., bitten by dog March 25th.
24. J. P., 7 years, from Minneapolis, Minn., bitten by dog March 25th.
25. L. P. D., 46 years, from Minneapolis, Minn., bitten by dog June 30th. The dog died rabid, and was diagnosed by Dr. Cotton.
26. H. M., 11 years, from Minneapolis, Minn., bitten by same dog June 29th.

1901.

27. G. B. N., 36 years, from Minneapolis, Minn., bitten January 20th, by dog which died rabid; so diagnosed by a local veterinarian.
28. E. O., 18 years, from Minneapolis, Minn., bitten March 29th, by dog which was pronounced rabid, and was killed the next day with well defined symptoms of rabies.
29. R. P., from St. Paul, Minn., had saliva of a rabid dog infect face and eyes on April 17th.
30. J. D. B., 2 years, from Leota, Minn., bitten by dog April 23rd, which in two days died of rabies.
31. M. A., 2 years, from Minneapolis, Minn., bitten by dog May 1st. Rabbits and guinea pigs inoculated have confirmed the diagnosis of rabies.
32. R. S., 7 years, from St. Paul, Minn., infected on the face June 15th. Diagnosis of rabies on dog made by Richard Price, City Veterinarian.
33. J. S. M., 34 years, from St. Paul, Minn., bitten June 5th, by rabid dog, so pronounced by Dr. Richard Price. Two weeks afterwards a goat, also bitten by same dog, developed rabies, diagnosed by Dr. D. A. Pomeroy.
34. D. A. L., M. D., 46 years, from Minneapolis, Minn., bitten by dog August 6th.
35. R. L., 6 years, from Minneapolis, Minn., bitten severely on face by a strange dog October 21st. On November 30th, the boy developed hydrophobia and died.*

1902.

36. Mrs. A. E. S., 40 years, from Minneapolis, Minn., bitten by dog January 9th.
37. C. L., 10 years, from Minneapolis, Minn., bitten by dog about January 28th. Inoculation experiments on rabbits gave positive results.
38. N. K., 21 years, from Eidswold, Minn., bitten by dog January 29th.

1903.

39. A. S. A., 28 years, from Herman, Minn., bitten February 20th, by a horse with fully developed rabies.
40. E. B., 15 years, from Herman, Minn., bitten February 20th, by a horse, as above.
41. H. O. S., 34 years, from Springfield, Minn., bitten March 8th, by dog affected with dumb rabies.
42. M. S., 32 years, from Springfield, Minn., bitten March 8th, by dog, as above.
43. E. S., 3 years, from Springfield, Minn., bitten by dog February 28th.
44. E. B. H., 5 years, from St. Paul, Minn., bitten by dog March 31st.

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*The post-mortem diagnosis of this case by the Minneapolis health department was "*Diphtheria*." The child was sick but two days and had no medical attendant. An autopsy was not permitted.

The above table gives a list of the outbreaks of rabies concerning which data has come officially to the Board. It does not pretend to be a complete statement of all the outbreaks of rabies, and certainly not of all the cases which have occurred in this state during this period. Unofficial information has been received concerning many cases of which the Board had no official record and these have not been included, nor have those mentioned above as occurring prior to 1896.

This table shows that the disease has been widespread in Minnesota, and from it one may gain some idea of the loss to the state which has resulted from rabies. On account of the paucity of information, the following estimate is very much lower than it should be. It requires no discussion.

ESTIMATE OF LOSS TO MINNESOTA FROM RABIES, 1896-1903.

*7 People (Dead)	at	$5,000	$35,000.00
30 People, Pasteur treatment (See Table I)			
44 People, Pasteur treatment (Chicago Record)	at	200	14,800.00
5 Horses	at	100	500.00
154 Cattle	at	40	6,160.00
109 Hogs	at	10	1,090.00
2 Sheep	at	3	6.00
2 Goats	at	5	10.00
198 Dogs	at	5	990.00
1 Cat	at	......	....
			$58,556.00

Apart from the commercial aspect of this disease, where human beings are exposed to infection, the public and private state of mind must be considered. It is impossible to express this in terms of dollars and cents.

The Board has certain knowledge therefore, as indicated in Table I, that 85 people have been exposed to infection with rabies virus. Of these seven have died. Sixty-eight have shown no symptoms. This is accounted for by the fact that 74 out of the 85 were given Pasteur treatment. Only two of 85 people who received Pasteur treatment developed symptoms of the disease. In

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*In Table I. only six deaths are reported, but the Chicago record showed another fatal case—No. 35—concerning which no official report had been made to this board. Of the thirty cases reported as having received Pasteur treatment only twenty-eight were included in the Chicago record, although the local authorities stated that these two cases had been sent, the name of the institute not having been given. This means then that at least seventy-four patients from this state were treated during this period.

one case, the reason for the apparent failure of the treatment was on account of the fact that it was not begun until six days after the patient had been very severely bitten on the face, the location of the bite being an important factor. As noted by the Director of the Pasteur Institute, the virus was of exceptional strength, symptoms of the disease appearing in 15 days and death occurring on the 16th day. No surgical treatment was given this patient until several hours after he was bitten, during which time he followed the rabid dog until he killed it. The attending physician believed that the vigorous exercise helped materially in the early and wide distribution of the virus. In the other fatal case it is not at all certain that the patient died of rabies, it having been reported as diphtheria. (See No. 35 Chicago record.)

Of 11 individuals bitten by rabid animals, but receiving no Pasteur treatment, five died from rabies and six developed no symptoms of the disease. In none of these six were the wounds received upon an unprotected surface. The clothing doubtless protected them from inoculation with the virus in the saliva. In two of them the wounds were very slight, and in all the six cases prompt surgical treatment was rendered.

How the Disease is Distributed and Remedies Therefor. The great variety of animals infected with rabies include not only domestic animals, but one wolf, and suspicion has been attached in at least two instances to the skunk as a means of starting these outbreaks. A fact which is worthy of some comment is that of the 110 hogs reported here as having been bitten by rabid animals, so far as can be ascertained, in only one instance did the symptoms of rabies fail to develop. In the report of this case, mention was made that the animal was only slightly scratched. This apparent susceptibility is of some importance, since hogs are rather vicious animals, and although usually confined in close quarters may be instrumental in the spread of the disease amongst their kind if not to other animals or man.

From the detailed reports and the table, it will be seen that rabid horses always tried to bite and were successful in injuring human beings in several instances. They have to be considered in the spread of the disease.

No attempt has been made to estimate the loss in poultry, although in many outbreaks this was considerable. Usually chickens or other such animals are immediately destroyed by the rabid dog, and they cannot be considered therefore, in relation to the infection of other animals.

Cows may also be excluded from the list of animals playing an important *role* in the distribution of infection, although it should be noted that people who have the care of the animals may be exposed to possible infection by milk, or in the attempt to give medicine, or when in any way there is danger of abraiding the skin and permitting the entrance of fluids containing the virus.

The dog is undoubtedly the chief factor in the spread of infection. In many of the outbreaks, notably Nos. 58 and 93, there are very complete and detailed histories which show that many animals or people may receive infection from one dog, even though they be widely separated, since these animals frequently run many miles.

In relation to the prevention of the disease, very strict measures should be adopted throughout this state. It has been suggested that a high license be established, and that all unlicensed dogs be destroyed by the local authorities, and if it be possible to ascertain the owners of such animals, that they be fined. The funds derived from the license and fine should be utilized for the payment by the state of damage resulting from dogs, including Pasteur treatment for bitten persons. Such measures would result in the destruction of ownerless curs, which for the most part seem to have been responsible for the epidemics in this state. The high license would probably initially increase the number of ownerless curs until they had been properly disposed of. If, after a proper trial of these measures, the disease be not stamped out, by the addition of a general law compelling the muzzling of all dogs, the elimination of this disease may be secured, as in those countries in which it has been in vogue. The muzzling order would be very difficult indeed to enforce in this state unless it were shown that no other method would answer the same purpose. In those countries where muzzling ordinances have been so markedly successful, there are practically no ownerless dogs, owing to the previously existing and rigidly enforced taxation system.

This matter received some discussion at the Minnesota Sanitary Conference, held January 14th and 15th, 1902. (See 19th report Minnesota State Board of Health, p. 90.)

There is a widespread belief that skunks are frequently responsible for the distribution of rabies, and in more than one of the outbreaks here reported there seems to be a basis for that belief. In the outbreaks referred to, the dogs exhibited wounds which were presumably made by skunks and within the usual time developed undoubted symptoms of rabies, which were verified by laboratory examination of them or animals infected by them.

n the case of wolves, skunks or other wild animals, there is
ably little to be feared, however, if provision be made for the
ention of the spread of the virus by dogs.

eographical Distribution of Rabies in Minnesota. Amongst the
iest reports of the existence of rabies in this state were cases in
vicinity of St. Paul and Minneapolis. With the progress of the
stigation it has been found that by far the greater number of
reaks and cases have occurred in this neighborhood, and certain
he outbreaks at considerable distances from these cities have
r been traced directly to rabid animals which started from
Twin Cities, or there has been reasonable ground at least for
ecting these localities as the original sources. The accompany-
map shows the location of those outbreaks which have been
rted officially to the Minnesota State Board of Health, and it
be seen that the northern part of the state is, comparatively
king, free from this disease. Either the Twin cities have served
oci from which the disease has emanated from time to time, or
facilities for reporting cases and the presence of a larger pro-
ionate number of veterinarians has led to more careful investi-
on and record of cases in their vicinity.

n important factor in the recognition of cases in these
lities has been the stand taken by Dr. Richard Price, who made
y endeavor in the earlier years to investigate all suspicious
s. His work resulted not only in the report of a great many
s by himself, but undoubtedly stimulated others to more careful
stigation.

onsiderable difficulty has been experienced in securing accurate
concerning the source of infection, the number of animals
n and their fate. In 1892, there was issued from the office of
Secretary and Executive Officer of the Minnesota State Board
ealth, a circular on rabies asking for information of suspicious
and giving hints as to the necessary steps in the treatment of
ds and the diagnosis of the disease.

t was found necessary to modify this circular so as to aid in
securing of information and to arouse a proper spirit of co-
ation in relation to diagnosis of the disease and prophylaxis.
rdingly on Aug. 15, 1899, another circular was issued which
s as follows:

abies (Hydrophobia). The investigations *conducted in the
teriological laboratory of this Board during the last three years

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Report of the Minnesota State Board of Health, 1895-98.

have shown that rabies is much more prevalent in Minnesota than was formerly thought to be the case, though it is believed that it is not so prevalent as might be inferred from local newspaper reports. It is desirable, therefore, to know how many of these supposed cases are really rabies in order that:

(*a*). If the wrong diagnosis has been made, the fears of the community and of persons bitten or owning bitten animals be allayed.

(*b*). If the clinical diagnosis be correct, proper protective and curative measures may be taken in time.

The Duties of the Local Health Officer in a Case of Supposed Rabies:

1. Do not kill the suspected animal, but if possible secure it alive and without injury. Confine it in a safe, quiet, roomy and comfortable place.

2. Report full particulars to the Secretary of the State Board of Health, St. Paul, Minn.

3. Secure and keep under observation (*i. e.* quarantine) all animals known to have been bitten.

4. Keep the supposedly rabid animal under the observation of a competent veterinarian for at least 10 days. (If the animal does not die within eight days from the onset of symptoms, the disease is probably not rabies).

5. If the animal dies or has to be killed for any reason before or during confinement, care should be taken not to injure the brain or spinal cord.

6. The disease may or may not have been rabies, but an accurate diagnosis may usually be made by the laboratory if the following directions are observed:

(*a*). Cut off the head and several inches of the neck of the animal.

(*b*). Do not permit any antiseptic to come in contact with the specimen.

(*c*). Place the head in a piece of new oil cloth, or waterproof material, gather up the corners and edges so as to form an improvised bag and tie tightly so as to prevent all possibility of the escape of fluids. Place in a water-tight box or tin vessel. If in freezing weather, freeze the head and keep it frozen, if possible, until it can reach the laboratory or until it is placed in the express car. If it cannot be frozen, pack the water-tight box in a large quantity of ice and dry saw-dust in a second box. If it is impossible to freeze the head or to secure ice for packing, the brain and upper portion of the spinal cord should be removed in as aseptic a manner (without the use of antiseptics) as possible, and placed at once in pure glycerine in a clean sterile glass vessel.

(*d*). Whatever the method of preparation, the box containing the specimen should be labeled as follows: Bacteriological Laboratory, Minnesota State Board of Health (State University), Minneapolis, Minn.

(*e*). Ship by express prepaid.

(*f*). Send to the laboratory (see above address) by mail, special delivery, all data obtainable.

When specimens are received, susceptible animals, usually rabbits, are inoculated under the skull and kept under observation. Positive diagnostic symptoms appear usually, if at all, in from three to six weeks.

If from any cause, such as improper method of killing the animal or packing the head, delay in shipping or during transit, the brain and spinal cord become contaminated or decomposed, the material on injection may produce a meningitis, resulting in the death of the inoculated animal before symptoms of rabies have had time to appear. It is, therefore, necessary that the above steps be taken as soon as possible after the death of the animal.

Treatment of Patient. It is the duty neither of the local board nor of the State Board of Health to prescribe treatment, but the following suggestions may be of value:

1. Promote free hemorrhage from the bite by use of a warm bath or warm, moist fomentations.
2. Use antiseptic dressings.
3. Use all vigilance in dealing with the case, but at the same time allay the fears of the patient and friends. Less than 17 per cent of people bitten by mad animals die of rabies, and after treatment by Pasteur's method, the mortality is less than 1 per cent.
4. If the biting animal has been killed, or has died, after exhibiting symptoms of rabies, no time should be lost in sending the bitten person to a Pasteur Institute, of which there are several in this country.

Precautionary Measures. Since rabies is ordinarily spread by means of dogs, more careful surveillance of these animals would appear advisable.

All owners of dogs should be required to register them and provide them with evidence of the fact by collar and tag.

On the appearance of rabies in a community, all dogs should be muzzled or safely confined.

When a dog or other animal is known to have been bitten by a rabid animal, it should be confined safely, but comfortably, for two months or longer, or destroyed as soon as the proof is furnished that the biting animal was rabid.

H. M. BRACKEN, M. D.,
Aug. 15, 1899. Secretary and Executive Officer.

In order to still further facilitate the collection of information of those cases which were investigated in the laboratory, and still more on account of cases concerning which no information was received until it was too late for either clinical or laboratory investigation, another circular was issued in 1902. By means of this, it was hoped that a full history of the outbreak could be obtained, the original source located and all the animals, as well as people, who were bitten and their ultimate fate ascertained. However, in this disease, it is most difficult to obtain full histories and to know exactly the relationship of the various outbreaks which occur in any community.

In the preparation of these tables, maps, etc., it has been found necessary to go through a very great deal of correspondence, and it frequently happened that even after a prolonged investigation and full report thereon, further information concerning the fate of the bitten animals and the development of the disease in that locality could not be obtained.

Seasonal Distribution. Of 92 outbreaks of rabies diagnosed in Minnesota, it has been found impossible to obtain an accurate idea of the months of the year in which the most cases develop, owing to the fact that after the initial case in any particular outbreak, others subsequently developed from time to time, sometimes during several months. Only in the case of those animals which were investigated through the Veterinary Department or where specimens were reported upon in the laboratory, was it possible to know the date of the appearance of the disease.

The following is a table of these observations:

TABLE II. SHOWING DISTRIBUTION OF OUTBREAKS, BY MONTHS, OF RABIES IN MINNESOTA, 1896-1903.

In January, 5 outbreaks have begun.
In February, 16 outbreaks have begun.
In March, 7 outbreaks have begun.
In April, 6 outbreaks have begun.

In May, 6 outbreaks have begun.
In June, 3 outbreaks have begun.
In July, 6 outbreaks have begun.
In August, 10 outbreaks have begun.
In September, 2 outbreaks have begun.
In October, 13 outbreaks have begun.
In November, 11 outbreaks have begun.
In December, 7 outbreaks have begun.

A minute discussion of Table II. is unnecessary, as it is impossible to know anything further than that the outbreaks of the disease have not been more common in the heated months than in cold weather. Too few outbreaks, however, have been observed to warrant any general conclusions.

Methods Employed for Diagnosis. In these investigations, the history of the disease has proved of great value in diagnosis. In many cases, as will have been seen from the detailed reports, it has afforded a complete basis for diagnosis. Wherever possible the laboratory has been utilized for establishing or corroborating the diagnosis. The method usually employed in the laboratory has already been described under the circular of information, and it may be stated that subdural inoculation of rabbits with an emulsion of the cord, medulla or brain of the affected animal has proven very satisfactory. Symptoms of rabies developed in the rabbits, as a rule, within two to three weeks. Where contamination of the material sent in for investigation has occurred, it has nevertheless, been found possible to render a diagnosis in many instances. It was surprising that bacterial meningitis did not more frequently develop in inoculated rabbits before there was time for symptoms of rabies. Where the material sent in for investigation is not fresh, it is wise to inoculate a second or even a third series of rabbits. When this is done, the micro-organisms, which are found present in the original material, in most instances disappear, so that when cultures are made from the nervous systems of the first pair of rabbits they are found to be sterile. Inoculation of this bacteriologically sterile material and the production of typical rabies symptoms renders a positive diagnosis certain. In one instance,* it was necessary after recognizing and identifying micro-organisms in the brain sent in for diagnosis, to neutralize the effects of the micro-organisms by antitoxic serum in order to demonstrate conclusively the presence or absence of rabies virus. The inoculation into the eye or the use of any other animals than the rabbit, has not been found necessary in the laboratory diagnosis of this disease, nor has the microscopic examination of prevertebral ganglia been practised, owing to the uncertainty of the results thus far obtained by other observers, and the interpretation placed upon their findings. Furthermore, it has been impossible in a great deal of the material upon which diagnoses have been made to utilize this method, owing to the fact that considerable time had elapsed between the death of the supposedly rabid animal and the receipt of the specimen in the laboratory.

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*Page 474. Biennial Report Minnesota State Board of Health, 1899-1900.

The length of time taken to diagnose this disease in the laboratory is not such a great drawback as at first sight appears, since where human beings are bitten, if they are to receive Pasteur treatment, it must be given immediately, and where animals have been exposed to possible infection they should be kept under very careful supervision.

In one instance the material forwarded to the laboratory for investigation consisted of saliva, but it was found impossible to obtain evidence of the presence of rabies virus, owing to the fact that the inoculated rabbits died with meningitis before a sufficient time had elapsed for the development of rabies.

On more than one occasion in this laboratory, milk from supposedly rabid cows has been inoculated subdurally, and in one case it was possible to show conclusively the presence of the rabies virus. In another case no discernible symptoms whatever resulted. The presence of rabies virus in milk is probably not very important unless the persons or animals partaking of it should have an abrasion in some exposed portion of the mucous membrane of the alimentary canal, since the digestive juices probably destroy the virus. In three instances rabid hogs were suckling litters of pigs during the period when they were exhibiting symptoms of rabies, yet in no case did any of the pigs develop the disease.

The usual period which elapses in rabid animals between the first evidence of symptoms and their death varies between three and eight days, but in one instance (outbreak No. 59, laboratory case No. 65) a period of almost 12 days elapsed between the onset of the disease and the death of the animal.

In one fatal case of rabies in a human being (outbreak No. 49, laboratory case No. 56) the virus was demonstrated in the brain seven hours after a thorough formaldehyde embalming by an undertaker.

The Pasteur Treatment of Rabies and the Necessity for the Establishment of a Pasteur Institute in Minnesota.

Too few cases have been included in this report to warrant the drawing of conclusions as to the value of the Pasteur treatment for rabies. The results have been already given in Table I. and commented upon. The efficacy however, of the Pasteur treatment has been too well demonstrated to require vindication.

This report includes 74 persons who have received the Pasteur treatment and 11 to whom it should have been given. There are doubtless many other individuals who should have received the treatment since 1896. Many animals have been lost, and some of them of considerable value.

It would, therefore, appear, in view of the widespread distribution of this disease and the necessity for immediate treatment, where treatment is required at all, that there should be established in Minnesota a Pasteur Institute under the direction of the State Board of Health or the State University.

This is a disease which affects both men and animals, and no apology is therefore necessary for here reporting the cases of human rabies, since rabies is a disease which must be studied both from the human and veterinary view points.

SUNDRY DISEASES OF HORSES.

Furunculus—*Minneapolis.*—April 3, 1901, Dr. C. C. Lyford of Minneapolis brought to the laboratory a small piece of tissue got from around a freshly opened suppurating point in the coronary band of the hoof of a horse. The ointment jar containing the specimen had a layer of vaseline in the bottom, though the jar had supposedly been cleansed and rinsed with methylated spirits. Direct coverslip preparations stained with eosin and methylene blue showed short chains of cocci, many of which were in pairs and many within the cells. No other organisms were found in direct coverslip preparations. Twenty-four-hour serum cultures showed staphylococci and short bacilli somewhat resembling diphtheria bacilli. (Types E. D. E^1. A. A^2. G.) (See p. 636, 18th biennial report Minn. State Board of Health.)

Infectious pneumonia—*St. Cloud, Stearns Co.*—Case 1. Sept. 27, 1901, there was received in the laboratory through Dr. C. C. Lyford, of Minneapolis, two test tubes which contained about 7 c. c. each of blood collected by him the previous day at autopsy on the body of a horse, the property of Mr. N. P. C. of St. Cloud. Direct coverslip preparations and cultures were made and examined. A number of bacteria of various kinds were found.

Case 2. On October 1st, there was received in the laboratory through Dr. Lyford, from Dr. S. H. Ward, of St. Cloud, six test tubes containing (a) portion of lung; (b) portion of heart wall; (c) portion of spleen; (d) portion of liver; (e) some pericardial fluid, and (f) heart's blood.

Case 3. October 4th, Dr. Wilson visited the farm of Mr. N. P. C., near St. Cloud, Minn., in company with Dr. S. H. Ward and made an autopsy on the body of a horse dead 24 hours. The animal showed intense pneumonia and pericarditis. Decomposition was well advanced. The results of all of the examinations were summed up in the following report to Dr. Ward:

Dr. S. H. Ward, St. Cloud, Minn.

My Dear Doctor Ward: We have to make a preliminary report on examinations made by Dr. L. B. Wilson, of the specimens received from the horses of Mr. N. P. C., St. Cloud, Minn. The specimens received through Dr. Lyford from the first horse were too badly decomposed for examination, but the specimens from the second horse brought by Dr. Lyford on Sept. 30, have been examined with the following results:

In direct coverslip preparations and also in cultures from the lungs, pericardial fluid and heart's blood, were found small Gram-staining diplococci, frequently appearing intracellular in lung specimens, and in fluid media growing out into chains of from 6 to 12 individuals. In all examinations it resembled diplococcus pneumoniæ.

The specimens from the third horse collected by Dr. Wilson, at autopsy performed by you showed the same microbe in coverslip preparations and cultures from both the lungs and pericardial fluid. Associated with this microbe in cultures from all tissues and fluid examined in both animals, except the lung in horse 2, were the diplococcus occuring in pure culture or in a mixture of *bacillus coli communis* and various putrefactive bacilli. This was due to the length of time which had elapsed between the death of the animal and the bacteriological examination, and it is unlikely these latter microorganisms have anything to do with the disease. That the diplococcus is related to the pneumonia and pericarditis clinically diagnosed by you and demonstrated in your autopsies, would seem probable. Should any of the other animals now sick afford an opportunity for a bacteriological and pathological examination soon after they are dead, we shall be glad to be present and collect material and go over the matter with you. This, however, Dr. Wilson told you on his visit, Oct. 1. If there is any other way in which we can throw light upon the matter, please command us.

F. F. WESBROOK.

Purpura hemorrhagica—October 15, 1901, Dr. Brimhall made an autopsy on a black horse, the property of Mr. J., Minneapolis, Minn. The horse had been suffering from acute laminitis for several weeks. The animal was killed because of a complication of *purpura hæmorrhagica* which debilitated the animal so rapidly that he was unable to stand. At autopsy found a number of local exudates into the skeletal muscles, also petechiæ on mucous membrane of the nose. One of the affected areas was opened and another one was dissected out and taken to the laboratory.

Direct coverslip preparations stained with eosin and methylene blue were examined, but no bacteria were found. Cultures were made in broth and on serum. After 24 hours in the incubator a small colon-like bacillus was found unmixed with other organisms in both broth and serum cultures.

Oct. 17, 1901, rabbit No. 456, weight 1,265 grammes, was inoculated in the posterior vein of the left ear first with three cubic centimeters of emulsion of a plain broth and a plain serum culture of the bacillus noted above. The rabbit was found dead on the morning of Oct. 21. At autopsy the brain was found to be pale. The heart contained very purulent blood. The blood itself was thin and dark. The spleen was swollen and dark. Liver darker in color than normal and bled freely on section. Kidney was congested. Direct coverslip preparations and cultures were made from the heart's blood, spleen, liver and brain. These showed bacilli which on further examination proved to be *B. coli communis.*

Oct. 17, 1901, rabbit No. 457, weight 3,595 grammes, was inoculated in the posterior vein of the left ear with 0.5 c. c. of an emulsion of a plain broth and a plain serum culture of the organism noted above. The animal having shown no symptoms up to Jan. 2, 1903, it was used for another purpose.

Bursatti—*Minneapolis.*—Aug. 7, 1902, Drs. Brimhall, Lyford and Wesbrook collected specimens from a horse which had been suffering from bursatti for several years, according to Dr. Lyford's account. The animal was a bay horse, infected over the right hip in an area about 10 inches in diameter, extending from close to the spine down over the hip irregularly, as also another focus of infection near the inner canthus of the right eye. The diseased area was covered with a dry crust, underlying which the surface was pitted in places, and when the crust was removed there was a continual escape of the sero sanguinous fluid. The skin was infiltrated and thickened to a depth of about one inch. A portion of the crust near the margin of the area over the right hip was removed, and a small superficial area was seared with a hot iron and broth inoculated by means of a hypodermic needle which was placed into the lower layers on the skin. Three such cultures made from this area and two from a point just beneath the right eye. A piece of tissue about 1 cm. square was removed from the lower margin of the hip lesions. The piece was about 0.5 cm. in depth. It was placed immediately in Zenker's fluid. After 24 hours in the incubator two of the broth cultures from the hip showed apparently no growth. One culture showed a short thick motile bacillus and staphylococci. One of the cultures from the eye showed no growth, the other a few long slender motile bacilli and many short narrow diplococci or bacilli. Subsequent cultures from this culture showed these latter organisms to be staphylococci or streptococci. The histological study of the tissue showed round celled infiltration and an appearance not unlike sarcoma. It was the intention to study further cases of this disease.

Sore Throats.—Aug. 21, 1902, Dr. C. C. Lyford of Minneapolis, sent to the laboratory a tracheotomy tube which he had removed from a pony which had exhibited symptoms of severe sore throat. Direct coverslip preparations and cultures showed staphylococci and *B. coli communis.* No diphtheria-like bacilli were present.

Meningitis (?)—*Montevideo.*—March 30, 1903, there was received in the laboratory from Dr. T. Lambrechts of Montevideo a bottle containing three pieces of spleen and two pieces of liver. On the following day there was received the following information, being a copy of a letter from Dr. Lambrechts:

Montevideo, March 28, 1903.

Dr. S. D. Brimhall, St. Paul.

My Dear Doctor: I sent to-day to Dr. Wesbrook specimens of liver and spleen of a horse that died here from an unknown disease. On the same farm three others have died (from the same cause, similar symptoms). The most common of these symptoms was paralysis.

On post-mortem nothing abnormal could be found. These horses were all fed millet hay.

Please inform me as soon as possible as to the cause.

Very truly,
T. LAMBRECHTS.

Direct coverslip preparations from the spleen stained with eosin and methylene blue showed many bacilli. Cultures in broth and on serum showed yellow and white staphylococci and an abundant growth of *B. coli communis.* Since the specimens had not been removed with aseptic precautions and were all in the same bottle, and since decomposition had already set in when they were received in the laboratory, the bacteriological findings above noted cannot be considered as of any etiological significance. It is possible that the disease affecting these horses may have been meningitis, but the evidence is insufficient to warrant such a diagnosis.

"SWAMP FEVER" IN HORSES

Introductory.—For more than twenty years in Manitoba, a very fatal though chronic disease in horses characterized by progressive wasting and anæmia, and accompanied by periodic pyrexia, voracious appetite and a characteristic "wobbling" gait has been well recognized. From the common name "swamp fever" it may be inferred that an etiological relationship between low-lying land, or the use of coarse native hay cut from swamps, and the disease has been suspected. Various explanations have been suggested, among them the unknown virus has been supposed to be carried by the water during periods of inundation and left after its recession in the grass around the border of the marsh. The eating over such pasture, or the use of hay cut from such a source, has been looked upon by many as the most probable means of transmission of the disease, although whether the virus is chemical or is really an animal or bacterial parasite has not been stated. The name "malaria in horses" is expressive of a belief in the periodicity of the accompanying fever and suggests the possibility of a blood parasite and a relationship to mosquito, fly or insect bites. This phase of the question has been thoroughly investigated by Drs. Bell and Torrance,[1] and frequent and persistent blood examinations in all stages of the disease—specimens having been collected at all hours of the day, as well as night—have failed to reveal anything in the nature of a plasmodium. "Surra"[2] is likewise thus excluded, as nothing resembling *trypanosoma Evansii* has ever been encountered in the blood, nor has the "*piroplasma equi*"[3] been seen. A common name in Western Canada, "pernicious anæmia in horses," is indicative of the progressive and marked hæmal changes which are to be observed in the disease, although the nucleated red blood cells and the poikilocytosis which characterize this condition in human beings have not been observed.

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[1] "Malarial Fever in Manitoba"—F. Torrance—Proceedings of the American Veterinary Medical Association, 1902, page 282, *et seq.* Also Veterinary Journal and Annals of Comparative Pathology, July 1899, Taylor.

[2] "Emergency Report on Surra," by Salmon and Stiles—Bureau of Animal Industry. Annual Report (18th), 1901, p 41 *et seq.*

[3] "Contribution a l'etude de *Piroplasma equi.*" Laveran. Comptes rendus hebdomadaires des Seances et Memoirs de la Societe de Biologie, p. 385.

For many years in Iowa, Nebraska and Dakota, a very fatal sickness in horses, known as "bottom disease,"[4] has existed, being apparently more prevalent in the low-lying lands along the Missouri river and assumed by some to be due to eating the plant known as "rattle box" (*Crotalaria saggitalis*). From the descriptions given it is impossible to say with certainty whether this is the same disease or not, although it would appear to be somewhat similar to swamp fever in its manifestations and course.

It is uncertain whether, in his "Pasteurellose equine," Lignières[5] includes this condition.

The European researches of Dieckerhoff,[6] Schütz,[7] Galtier and Violet,[8] and others leave us in doubt, as to the relationship of typhoid fever (*pferdestaupe*), infectious pleuro-pneumonia (*brustseuche*) and influenza (*scalma*). In connection with these diseases a cocco-bacillus (*bacille ovoide*) and certain varieties of streptococci and diplococci have been described. Lignières, endorsed to some extent by Nocard and Leclainche[9] has attempted to simplify the study of these affections by grouping them under "Pasteurellose équine." This group, he subdivided into:

1. Septicaemic form (typhoid fever, influenza).
2. Acute or subacute forms with all their localizations (contagious pneumonia, gastro-enteritis).
3. Chronic form (progressive pernicious anæmia).

Lignières believes that these widely divergent types of disease are all due to an ovoid bacillus (bi-polar) of the hæmorrhagic septicæmia group. He takes it for granted that where the bacillus is not recovered from the tissues of horses which have succumbed to these diseases, it has been initially present, and after undermining their resistance, the streptococcus of Schütz or some other bacterium has been responsible for the production of the final symptoms and death of the animals. In support of this hypothesis, he advances the result of artificial inoculation of this ovoid bacillus into horses where after the production of symptoms of typhoid and death, he failed to recover from the tissues the same organism but found the "streptococcus of Schütz," which he believes to be a specific microbe differing constantly from streptococcus pyogenes (hominis). Observations on the disease "a frigore" in the dog are taken by him as corroborative of his assumptions concerning the etiology of the above mentioned group of diseases in the horse.

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[4] "Bottom Disease" among horses—E. C. Schroeder; U. S. Bureau of Animal Industry Reports, 1891-92, p. 371 *et seq.* Also First Annual Report of the State Veterinary Surgeon of the State of Iowa, 1885, p. 16 *et seq.*

[5] Bulletin de la Societe Centrale de Medecine Veterinaire—Paris. June 1 and July 22, 1897—Dec. 30, 1898, and July, 1900.

[6] Dieckerhoff—"Die Pferdestaupe." Berlin, 1882.

[7] Schütz—"Uhrsache der Brustseuche der Pferde"—Archiv für Thierheilkunde, Vol. XIII, 1887, p. 27.

[8] Galtier et Violet—"Les pneumo-enterites infectieuses des fourrages." Paris, 1890—Galtier, "Traite des maladies contagieuses," Dieuxieme Edition, Vol. II, 1892, p. 649.

[9] Nocard et Leclainche, "Les Maladies microbienne des Animaux."—Dieuxieme Edition, Paris, 1898, p. 67 *et seq.*

The grouping of diseases, clinically so ill defined, tends to obscure matters, and as already stated it is impossible to say whether the disease or diseases already mentioned as occurring in the United States and Canada (swamp fever, malaria in horses, pernicious anæmia, etc.) are included in his classification, and whether he has been able to show specifically for this disease a relationship to the bacillus of the hæmorrhagic septicæmia group.

Certainly in the absence of the very fullest clinical, bacteriological, pathological and experimental evidence it would seem difficult to believe that equine typhoid fever, the various pneumonias, influenza and "swamp fever" had a common etiology. In the mean time, the most careful study with full report in detail of individual cases is necessary before proceeding to any sweeping generalities.

There is then a disease or group of diseases described under various names in the western portions of Canada and in certain sections of the United States. In Manitoba the disease is responsible for the annual loss of many thousand dollars' worth of horses. Its prevalence may be gauged by the report of the loss by one railway contractor in a few months of more than ten thousand dollars worth of horses. Throughout the province, particularly along the valleys of the Red and Assiniboine rivers and in general in low-lying districts, the disease is found. Although by many it has not been deemed infectious, and there is no hesitation in the stabling of the diseased with well animals, such a menace to the welfare of the agricultural districts demanded attention. The Provincial (Manitoba) and later the Dominion Government authorities deemed the matter of such grave importance as to merit special investigation. The work primarily begun by Drs. Torrance and Bell on their own responsibility and at their own expense was extended by provincial and government aid, although it was carried forward under very great difficulties so far as provision for experimental work was concerned. The presence of the disease in localities conveniently accessible to headquarters (Winnipeg) enabled them to obtain very complete histories and to make frequent clinical and laboratory examinations. The clinical and pathological pictures presented in their reports leave little if any room for doubt that the Manitoba disease is the same as that described in this report.

The etiology of the disease in Manitoba still remains in obscurity, since inoculations of fresh blood from clinical cases, and of cultures obtained at autopsy, have failed to reproduce the disease in horses, whilst no uniformity has been encountered in the bacteriological study of the cultures from animals sick or dead of the disease.

HISTORY OF THE DISEASE IN MINNESOTA

For a number of years, the Veterinary Department of the Minnesota State Board of Health had heard rumors of the occurrence of a chronic disease in this state which was attributed by the farmers and owners of stock to the use of swamp hay or otherwise identified with grazing over and feeding from low-lying land. These rumors came largely from the northern part of the state in the districts around the Red and Red Lake rivers. From the vagueness of these rumors and the fact that there were relatively few veterinarians in the districts affected, the histories of the cases and other data concerning the disease, were derived from the owners of affected stock. Of necessity, there were many discrepancies in the reports received, all of which came in a roundabout way without specific requests for investigation.

It seemed to the board a very doubtful policy, when it had so much in the way of specific routine together with a number of investigations which had already been begun, to commence an investigation based largely upon rumors.

Being familiar however, with the fact that the disease was prevalent in Manitoba, knowing that it was under investigation there, and being in correspondence with the Manitoba investigators, this Board was on the alert for information relative to the disease in Minnesota since 1900. No direct information of cases for investigation could be obtained until the autumn of 1901. For some weeks prior to this time, through a misconcepton, requests for investigation were addressed to the State Experiment Station, under the mistaken impression that the State Board of Health Veterinary Department was located there. As a result, much delay ensued and the Board was blamed for apathy concerning cases of which it had no knowledge. After this work had been started, veterinarians and other observers throughout the affected districts in this state recalled the occurrence of seemingly the same disease for the past six years, and Dr. Langevin, of Crookston, believes that the disease existed in the northern part of the state when he first came there something over twenty years ago.

Methods.—The rumors of this disease came principally from the northwestern portion of the state, that is, some three hundred miles or more from Minneapolis which rendered satisfactory laboratory work more difficult than it would otherwise have been. The experience of the board indicated that the only satisfactory method of investigating an unknown disease consisted in the personal visit of veterinary and laboratory representatives. Workers from these two departments were sent out fully equipped for the collection of data and clinical and laboratory specimens, as well as for laboratory investigation in the field. From the outset a firm stand was taken that investigations would not be done unless the owner of the sick horses was willing to afford opportunity not only for clinical investigation, but for post-mortem work. In spite of a very natural desire on the part of owners to have diseased animals treated, and the well animals protected, without regard to the diagnosis, the very high mortality of the disease rendered them skeptical of an ultimate cure and made them more willing to permit the killing of the animals.

Throughout the investigation, all interested persons have shown a spirit of co-operation which developed as soon as it became evident that steps were being taken to find out the cause of the disease and its means of transmission, with a view of preventing its spread, if a cure were found impossible. At first it was necessary to overcome the fatalistic idea which had arisen on account of the chronicity of the disease and its high mortality, many individuals believing that after an animal was infected, its death might be expected in due course.

Various theories as to the cause of the disease and methods of transmission were prevalent. On one or two occasions, after receipt of telegrams, representatives of the board went several hundred miles expecting to hold one or more autopsies, only to be requested to prescribe for the sick animals and to prevent the further spread of the disease. On pointing out that before curing or preventing the disease it was necessary to find out the active cause and the means by which infection was carried, no further difficulty was encountered, and every possible help was rendered on the part of those interested.

The initial difficulties met with were largely due to the great variety of clinical symptoms and history of onset, and it seemed impossible to know at first whether the different animals seen and reported were all suffering from the same disease.

In brief, the methods pursued during this investigation were as follows:

1. Immediately upon the receipt of a report of a case in which investigation was desired, permission to make an autopsy was secured either by letter or telegram, whereupon representatives from both the veterinary and laboratory departments went to the infected locality taking with them a full laboratory field equipment.

2. As full a history as possible of the disease upon the affected farm and in the neighborhood was obtained. For this it was necessary to depend upon the memory of those interested with a resulting vagueness, which could not be avoided.

3. Careful observations concerning the environment, methods of feeding and housing stock, the water supply and other such general matters were made.

4. A thorough clinical examination was given the affected animals. This included not only physical examination, but laboratory study in the field in a large number of cases. Such methods did not, of course, yield as satisfactory results, as if continuous observations and daily records had been possible. The distance away from the laboratory, the necessity for immediately returning with the cultures and other materials collected, precluded day to day observations, and in only a few cases were the patients seen more than once. The department was not provided at first with any place in which sick animals could be kept, and although later the Laboratory of Animal Research permitted of the housing of such animals, it was only possible in one instance to secure a clinical case and have it brought to the laboratory where it could be under continuous observation. Unfortunately, this animal succumbed within six days after its arrival. This phase of the work had been planned, but before the completion of the building the disease had subsided and it was impossible to secure satisfactory cases. Relative to shipping of such cases, it may be mentioned that among those who are most familiar with the disease it is not believed to be infectious, nor has evidence to the contrary been obtained, and it would appear possible to ship animals safely from place to place if due care be taken.

From the rumors which had been heard concerning this disease and the early observations of this board, and investigations in Manitoba, attention was particularly directed to the blood. In the earlier cases therefore, where it was at all possible, microscopic examinations of the fresh blood were made and the counts of red and white cells recorded throughout the investigation. Living blood was examined for several hours at a time for the presence of blood parasites with negative results. The hæmoglobin was estimated by the von Fleischl instrument in the first few cases, but abandoned owing to the fact that the bar of this instrument could not be matched with the blood, which was much yellower in tone. In the later work the Tallquist method was employed. Direct cover slip preparations of the blood, fixed in alcohol and ether, or by heat, were brought to the laboratory and stained with eosin and methylene blue, Gram and Bismarck brown, Nocht-Romanowsky and Jenner's stains. For blood counts, hæmoglobin estimations and blood smears, it was found almost impossible to secure specimens by making an ordinary skin puncture, and the usual proceeding was to collect the blood as it flowed through a large needle from the jugular vein. In the records of cases which follow this was the method employed, unless otherwise specified.

Blood cultures were also made from the living animal, and where the owner was doubtful about allowing the animal to be killed for autopsy such cultures were always taken, if possible. The method employed in collecting this blood was devised to avoid possible contamination from outside sources, such as the skin, air, etc., and at the same time to permit of getting sufficient blood, in case the bacteria in the circulation were few in number.

A flat flask of about 100 c. c. capacity was provided with a rubber stopper having two perforations. Through one of the perforations, a glass tube passed nearly to the bottom of the flask and the projecting end was constricted in the flame, bent slightly, and to it had attached a rubber tube upon the other end of which was a large needle or trochar, contained in a test tube. The mouth of the test tube was plugged with cotton, which surrounded the rubber tube above the needle and prevented the entrance of micro-organisms. Through the other perforation in the rubber stopper, a short length of glass tube was inserted, so as to reach only a short distance below the stopper. Upon the free end, which was two or three inches long, a small bulb was blown and this was filled with cotton. Below the bulb the glass tube was constricted and bent in the flame. Into this flask about 70 to 80 c. c. of fresh peptonized beef broth was placed and the whole apparatus, including the needle enclosed in the test tube and with the rubber tube in position, was sterilized in the autoclave. The rubber stopper was secured in place after autoclaving, by a sealing wax for glass. The broth in the flask was found to remain sterile indefinitely. These flasks were carried in such a way as to always remain in a vertical position.

In the field, the neck of the animal whose blood was to be examined, was shaven with knife or razor, thoroughly scrubbed with soap and water, followed by alcohol and corrosive sublimate. By means of a knife which had been sterilized immediately before in the flame, a small cut was made in the shaved sterilized skin over the jugular vein. The needle which was attached to the flask by means of the rubber tube was withdrawn from its test tube and thrust through the cut in the skin into the jugular vein. The air in the flask was exhausted by sucking upon the short glass tube which had been plugged with cotton, whereupon the blood flowed directly from the vein into the flask, and by gently shaking was thoroughly mixed with the broth therein contained. This diluted the blood and reduced to some extent its bactericidal powers, ordinarily increased during coagulation. After the withdrawal of about 10 to 20 c. c. of blood,* the rubber tube connecting the needle and flask was pinched with the fingers, and the end which fitted over the butt of the needle removed. Reversing the process by which the blood had been withdrawn from the vein and blowing through the short plugged glass tube, the blood which remained in the rubber tube and in the glass tube leading to the bottom of the flask, was expelled. When the mixed broth and blood appeared in this tube at the constricted bent portion above the rubber stopper, heat was applied from a blast lamp, and the tube hermetically sealed. At the constricted portion of the other tube, i. e., below the bulb containing the cotton stopper, the glass was also hermetically sealed in the flame. The use of a rubber tube between the needle and the glass tube, as also the use of a small piece of rubber tube attached to the mouth piece, avoided the danger of accident, due to movement of the horse, and the method was employed throughout the investigation with great satisfaction.

The sealed flask was brought to the laboratory for incubation and examination. Sub-cultures were made from it, where micro-organisms were found to develop.

Where swellings were found, such as upon the breast, neck or in the joints, either by means of one of these blood culture flasks, or a sterile glass pipette, fluid was collected in an aseptic way, mixed with a large quantity of broth and brought to the laboratory and examined for micro-organisms. In one or two instances, also urine was collected during urination in a sterile receptacle, and mixed with large quantities of broth and incubated. The urine was also examined more than once, chemically. The delay in transit rendered the examination of less value.

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*Care should be taken to see that the mixture does not contain too much blood, as some micro-organisms are masked in the clot.

5. *Autopsies.*—Where the animals had died before the arrival of the representatives of this board, unless putrefaction was already advanced, an autopsy was held. In most instances, however, as already stated, the animals were killed, either by bleeding or shooting in the head, and the autopsy immediately performed. Careful observations were made for the presence of swellings, subcutaneous hemorrhages and those situated between the muscles and fascia, and on the serous surfaces. Notes were taken of all gross findings. Materials were collected for examination from all tissues which showed microscopic change and were preserved, as a routine, in the three fixatives, 10 per cent formalin, 96 per cent alcohol and Zenker's fluid. In addition, as a routine, specimens of the various viscera were always taken. Blood smears and smears from the fluids found in the different cavities, and pus and other pathological exudates were made, as well as of the various organs of which small specimens were fixed, as already noted. The making of direct smears required care to prevent the deposit of dust, and they had also to be protected against flies, during the summer months. Where it had been impossible to collect urine or blood during life, these materials were collected at autopsy, so as to permit of microscopic, cultural and chemical examinations.

After the first few examinations, when it had been found possible to demonstrate micro-organisms in all the cases, less attention was paid to the search for blood parasites and every care taken to investigate thoroughly the possibility of bacterial infection.

Cultures were taken as a rule in the following way, and it frequently became necessary, in order to secure a satisfactory culture, to sacrifice the gross or microscopic specimens during the burning of the exterior.

(a) Cultures were made from the contents of abscesses, or from œdematous or hemorrhagic areas, as they were found subcutaneously between the muscles, or in the lymphatics. The procedure was to thoroughly burn the exposed surface by means of a gasoline blast lamp. The material, if fluid, was collected by means of a sterile pipette, into the mouth piece of which cotton had been inserted before it was sterilized, the other small free end having been sealed in the flame. The sealed end was broken off, the slender tube, sterilized by heat with the blast lamp, was thrust through the burnt outer surface of an abscess, or other collection of fluid, and the material drawn into the pipette in considerable quantity, whereupon a few drops, sometimes as much as 5 c. c., were blown into tubes containing nutrient broth, and upon the surface of agar and serum. Throughout these investigations, dependence was placed upon the use of broth cultures, it being found possible to carry tubes of broth in an upright position without serious inconvenience.

In the case of œdematous tissues or solid materials, very frequently a small portion was cut off with sterilized scissors, after the surface had been flamed thoroughly, and the piece dropped directly into broth. Smears for microscopic examination were made at the same time. In a few cases where the blood pipettes were not at the moment available, swabs were used for collecting the material from œdematous areas or abscesses. After thoroughly flaming the surface, and incising it by means of a hot knife, a sterile swab was thrust into the interior and thoroughly impregnated with the fluids. It was then immediately shaken out into tubes of broth and then used for wiping over the surface of agar and serum tubes.

(b) Cultures from joints were made in a similar manner to those described above.

(c) In case of the pleural, pericardial and peritoneal cavities, before opening, the outer surface was thoroughly seared, and by means of a pipette the fluid was withdrawn and a fairly large quantity, i. e., from 1 to 5 c. c. blown into 5 to 10 c c. of broth, and a few drops upon the surface of agar and serum tubes. Urine was collected on more than one occasion by the same process.

(d) Blood cultures were always made at autopsy, even though they had been collected before the death of the animal. A pipette was used for this purpose, and after searing the epicardium the pipette was thrust either through the heart wall into the cavity, or where the large vessels had already been cut, and danger of contamination was feared, a branch of the coronary vein was selected and several c. c. of blood was drawn up into the pipette, and from 1 to 5 c. c. blown out into 5 to 10 c. c. of broth. It should be mentioned that pipettes were used for collecting blood, pus, joint fluid, urine, bile or other such fluids. After the broth, serum and agar cultures were made, both ends of the pipette were fused in the blast lamp, and it was brought with the cultures to the laboratory.

(e) In the case of the lungs, liver, spleen, kidneys, heart wall, spinal cord, etc., either before the removal of the organs, or immediately after their removal, the outside was thoroughly seared and a puncture made by a knife which had been immediately before thoroughly flamed. By means of a swab, broth, serum and agar cultures were inoculated, and cover glass smears were made from the cut edges of the specimens removed for microscopic examination before they were put into fixative.

From the foregoing, it is apparent that a fairly well equipped traveling laboratory was carried in all cases, and it was necessary to select with some care the site at which the autopsy was to be performed, as shelter from the wind was necessary to some degree, and it was very desirable that the animal be buried at the spot where the autopsy was held. This point was kept in mind as much as possible, in order to impress upon the owners the necessity for the protection of well animals upon the place. Some attempt at photographing affected animals, and barns, and surroundings in infected districts was made, but without a great deal of success.

6. Upon returning to the laboratory, the notes made in the field were immediately gone into, a full description of the clinical aspects and what was found at autopsy and everything which had been done was placed upon record. Materials which had been gathered were subjected to a routine examination, as follows:

(a) All the cultures made during life, or at autopsy were placed in the incubator for 24 hours, and then examined, to see if growth had take place. If no change could be observed they were placed in the incubator for some further time and again examined macroscopically and microscopically.

In the case of cultures made from fluids, such as blood, although no growth seemed to develop for several days, on more than one occasion it was found that later growth could be observed where all possibility of contamination could be eliminated. This serves to show the bactericidal properties of blood and body fluids.

(b) In all cases the original cultures were examined for purity, and by streaking out, plating and other methods, the various bacteria were isolated. On many occasions, by going back to the original cultures, the presence of an organism which had escaped attention in the isolation work was found. If it had not been for this method, it is likely that in certain of the examinations, notably Cases 9-10-11, *B. equisepticus* would have been overlooked, owing to the fact that *B. pyrogenes equinus* was very abundant.

(c) In the identification of bacteria, their morphology, methods of staining, motility and spore formation were all carefully noted; their cultural characteristics in the common media, such as broth, agar, serum, gelatine, Dunham's peptone solution and potato were observed. Gas and acid formation with the sugars, dextrose, maltose, lactose and saccharose were tested. The presence of indol was looked for and the results recorded, as also the action upon milk and litmus milk. In determining the pathogenesis, various laboratory animals were used, but information concerning this will be found under "Pathogenesis" in a description of the micro-organisms, *B. equisepticus* and *B. pyrogenes equinus,* and under "Experimental Investigations."

(d) In order to determine the relationship of the various bacteria found, to this disease, various animals, including horses, swine, dogs, rabbits, guinea pigs, pigeons, etc., were used for inoculation.

Attempts were made to extract toxines, and full notes, including daily or hourly observations upon the symptoms, and in the case of horses, blood counts, temperatures, etc., etc., were recorded. A fuller description of this will be found under "Experimental Investigations."

DETAILED REPORT OF EXAMINATION OF CASES OF "SWAMP FEVER."

The following is a detailed report of the examination of cases of "Swamp Fever":

Outbreaks I. and II.

Cases 1–5, 9, 10, 18, *Beltrami, Polk Co.*—Nov. 2, 1901, Drs. Brimhall and Wilson visited Beltrami, Minn., on a report of the presence of swamp fever received through the local town chairman, Mr. Gullickson, and made inquiries concerning and collected specimen from five supposed cases of the disease. The disease has been prevalent in the neighborhood for several years and a small outbreak usually occurs each spring, from April to May, followed by a partial or complete cessation of the disease during June and July and then a second and larger outbreak begins in August, and extends throughout September and October until cold weather intervenes. The country in the vicinity is in the midst of the Red River Valley, i. e. old Lake Agassiz basin, and is consequently quite flat. The Sand River flows near the town, and both spring and fall frequently overflows its banks. It sinks into a marsh west of Beltrami. Many of the cases were said to have occurred in horses which were in low pasture on land which had recently been overflowed by the river. This, however, was not true in all cases, one man, Mr M., having lost a number of horses last fall with the disease, and none of them had been on low pasture, i. e., on ground overflowed by the river.

Mr S. had three horses sick at the time of this examination, yet on his farm was no low ground, and two of the horses had not been running in pasture of any kind for several months before they became sick. Mr. O.'s mare, which was sick at the time of this examination had not been in pasture for several months, though a branch of the river ran through Mr. O.'s farm. Animals of all ages were affected. Previous good health or good condition seems not to be a factor in determining outbreaks.

The first symptoms noticed are usually moping or "dumpishness" on the part of the animals. They begin to be weak, particularly in the hind legs, rapidly lose flesh though consuming large quantities of food, since in most cases the appetite is retained until the very last. Some of the animals become mere skeletons in two weeks after the onset of symptoms; in others, the disease is much slower, running four to six weeks or as many months before the animal finally goes down. In some cases recovery occurs before the animal becomes so weak as to need help in getting up. When once the animal is down as a rule it dies within a week or two. The membranes appear to be very pale, and the blood is reported to be very light colored or almost absent entirely.

Direct coverslip preparations were obtained from five animals. *Case* 1—Mr. O.'s mare sick two and a half days. *Case* 2—Mr. S.'s colt sick one month and barely able to stand when specimen was taken. *Case* 3—Mr. S.'s colt sick one month, but not so ill as (2). *Case* 4—Mr. S.'s black mare sick two weeks, not very ill and apparently recovering. *Case* 5—Mr. S.'s brown mare sick only a few days. No symptoms except "dumpishness." May not have the disease.

Five coverslip preparations were taken from each animal. These were fixed in the flame and two from each animal stained with eosin and methylene blue. No bacteria were found present on any of the coverslips except in one of the two of Mr. S.'s colts (3). This had apparently not been sufficiently fixed in the flame and bacteria may have multiplied on it.

Direct coverslip preparations from each animal were also stained with Nocht's modification of Romanowski's eosin-methylene blue stain for malarial organisms. No foreign organisms were found in the bodies of any of the red cells. The leucocytes appeared to be very much increased in number in proportion to the red cells, though they were not counted. The coarsely granular oxyphile cells were especially numerous in the specimens from Case

Horse barn of Mr. Wm. S——, one mile north of Beltrami. Behind the barn the yard was rather low and boggy, but Mr. S—— was constructing a drain and filling, so as to obviate this difficulty. The house is in front and to the left on a raised sandy knoll. A flowing well near the point from which the photograph was taken gives rise to a small creek which keeps the surrounding black loam in a rather boggy condition owing to the flatness of the land. (Outbreak II.)

4. It may be noted that this animal had on her chest, at the time the specimen was taken, a large "bunch," evidently an abscess containing pus.

Nov. 16, 1901, Drs. Brimhall and Wilson again visited the farm of Mr. S., one mile north of Beltrami, Minn., to inspect Case 2. The farm is flat, covered for the most part with the rich black loam of the Red River Valley, but on the southwest corner in the direction of the Sand river is a gravel and sand ridge. The water is obtained from a flowing well between the barns and the dwelling house. Everything about the farm showed signs of careful supervision and prosperity. The horse stable was floored, and, although both horse and cow barns were situated on relatively low ground, provision was being made for raising and draining the barnyard. Some idea of the character of the stabling accommodations may be obtained from the cut No. 1.

The colt noted above as Case 2 had been sick about six weeks, and had grown gradually worse since the previous visit, November 2d. When seen November 16th he was down and unable to rise. The animal was killed by shooting and a complete autopsy made.

On removing the skin a few small petechial, hemorrhagic areas were found about the shoulder and groin. The right hind hock was considerably enlarged, the synovial membrane being puffy and filled with a cloudy, straw-colored serum. The cephalic lobes of both lungs were red, solid, airless and contained numerous pus cavities from one-quarter to three inches in diameter. About the middle of the dorsal border of the left lung was an abscess which bound down the pleura to the tissue ventral to the spinal column, involved the said tissue over an area of two or three inches and extended between the lateral process of the vertebræ into the spinal canal. The dura of the cord was apparently not involved. A few small hemorrhagic areas were scattered over the surface of the heart, particularly over the auricles. The liver was apparently normal except somewhat congested. The spleen was enlarged, pale and firm. The kidneys were a trifle pale, but otherwise apparently normal. The bladder was empty.

Direct coverslip preparations, broth and serum cultures and portions of tissue in preservatives were collected from the liver, lung, hock, spleen, anterior mediastinal gland, abscess of lung, dorsal abscess and blood from the carotid artery.

Direct coverslip preparations from the various sources noted above were stained with eosin and methylene blue, and on examination showed the following bacteria: From the carotid artery, lung, lung abscess, liver, joint fluid (hock), and anterior mediastinal gland, small diplococcoid bacilli. Preparations from the pus from dorsal abscess showed small somewhat slender bacilli, not belted but irregularly staining. Preparations from the spleen showed no bacteria.

Original Broth Cultures.—From the carotid artery blood, liver and spleen showed no growth. From lung, hock fluid, anterior mediastinal gland, lung abscess and dorsal abscess showed small diplococcoid bacilli, belted. In addition the cultures from the mediastinal gland showed chains of cocci in pairs. That from the dorsal abscess showed slender bacilli sometimes in pairs and occasionally in longer chains.

Original Serum Cultures.—No growth occurred on the serum cultures from the spleen. Serum cultures from the dorsal abscess developed only colon-like bacilli. From all of the other sources mentioned above cultures showed the small diplococcoid bacilli noted above. In addition, one colony of white staphylococcus was found on one serum culture from the anterior mediastinal gland.

Single colonies were picked from serum cultures from the various sources, except spleen and dorsal abscess, and grown on serum and then in broth. As a result, from the lung, liver, hock, carotid blood and lung abscess, a small diplococcoid belted bacillus was isolated in purity. It proved to be non-motile, non-Gram staining and otherwise indistinguishable morphologically from *B. bovisepticus*. This strain of *B. equisepticus* (description page 342) was found virulent for rabbits when tested several months later.

Blood was collected from the carotid artery and mixed with Toisson's fluid, brought to the laboratory and the red count made. Red cells were 5,420,000 per c. c.

Nov. 16, 1901, Drs. Brimhall and Wilson examined and collected specimens of blood for cell counting from the animal noted in the first report as colt No. 3. This animal had been sick about two months, and was apparently on the road to recovery. Blood was collected for the red and white count and brought to the laboratory. Red blood count of blood collected November 16th was 4,839,000 per c. c. The white blood count was not made.

On July 24, 1902, Drs. Brimhall and Wesbrook arrived in Beltrami in response to telegrams sent by Mr. Wm. S. Mr S. had thirty horses and had lost ten within a period of a little over a year, with symptoms which would seem to indicate that for the most part they died of the same disease. (In one animal a possible history of tetanus was obtained.) Mr. S. had lost three horses already this year, and several neighbors had also lost horses, or had them at that time sick with apparently the same disease so far as the histories could be obtained.

On July 24th two animals were found sick. One of these was killed, and will be referred to as Case No. 9. The second one, Case No. 10, was examined and specimens taken from it.

Case 9 was a brown filly with white face, rising two years old. She had been noticed ailing for three weeks, and was found lying down and unable to rise. She was greatly emaciated, but showed considerable œdema in the gluteal region, more particularly of the right hind leg. There was marked swelling extending from the left hock to hip, great pallor of the mucous membranes of the eye and mouth. Pulse, 80; temperature when first observed, 103½° F. Appetite very good. A suitable place for work was prepared on a spot where the animal could afterwards be buried. The animal was dragged on a stone boat to this place, and during the journey reached out and ate grass by the wayside. Examinations were made of the blood collected from the jugular vein during the forenoon, viz., for about four hours.

Blood coagulated very quickly, and when flowing from the artery was much lighter in color than usual. Hæmoglobin, 60 (Tallquist), 52 (von Fleischel), but even with yellow light the blood was much lighter than the bar, and could not be quite matched. A blood count was impossible, owing to an accident to the hæmocytometers. Microscopic examinations of fresh preparations showed cells which were of no greater diameter than one-fourth to one-fifth the size of the normal red cell. Others were seen which were twice the normal size. There was great variation also in shape. No bacteria were encountered, and nothing resembling any of the known hæmatozoa or filaria was found.

Culture.—By means of a sterile pipette about five c. c. of blood was collected from the jugular as it spurted in a large stream. This was placed in a flask containing 50 c. c. of sterile broth and was sealed in the flame of a blast lamp. The animal was bled to death by severing the right carotid artery and an autopsy held immediately.

Autopsy.—Absence of subcutaneous fat made skinning very difficult. As the skin was removed hemorrhages and a jelly-like œdema over right hip and around root of tail were seen. In the right gluteal region was a large abscess irregular in outline and containing about six litres of curdy, light yellow pus. The abscess verged on the right hip joint, nearly involved the rectum, extended along the iliac vessels, causing a thrombus of the right iliac vein, and presented in the sacral region beneath the peritoneum, where it caused a bulging. Over this bulging the connective tissue was infiltrated with a clear, yellowish fluid, so that between the peritoneal surface and the abscess there was about one to one and a half inches of a jelly-like material.

The right hip joint showed inflammation and infiltration behind the capsule, especially on the aspect towards the abscess. Particles of fibrin and a small blood clot were present.

The left hind leg, which was very greatly swollen, showed on skinning, in the sciatic region especially, a clear, yellowish, gelatinous infiltration of the superficial connective tissue extending from the hock to the pelvis and surrounding the whole leg. On cutting into this, yellowish red flocculi, apparently hemorrhagic in character, were found extending along the inter-muscular septum parallel to the inner aspect of tibia.

In the left sciatic region a large abscess which held about 1,000 c. c. of a fluid, reddish yellow pus (probably hemorrhagic) was encountered. In this was found a rounded hemorrhagic mass which somewhat resembled a lymph gland one and one-half inches by one-half inch in size. The left hip joint showed hemorrhages around capsule, and was purulent within the capsule. The right hock was greatly swollen, and contained a large quantity of straw-colored fluid.

Abdomen.—The mesentery of both large and small intestines, and capsules of the right kidney and spleen, showed patches of hemorrhagic infiltration irregular in size. A chain of hemorrhagic lymph glands extended from ileum to right kidney. The spleen and liver seemed normal, but were somewhat bloodless. Kidneys were pale, swollen and showed parenchymatous nephritis.

Thorax.—The lungs were stippled on the surface with minute reddish spots. The apices were red, solid, somewhat depressed, and studded all over with abscesses varying in size from a pea to a marble. The apex of the right lung was involved over an area of about four by five inches, the left somewhat less. In the other portions of the lung were three or four hemorrhagic solid areas from about one-half to one inch in diameter. The pericardium contained a considerable quantity of a clear straw-colored fluid. No hemorrhages were seen. The heart was tightly contracted. The muscle was pale, and one of the leaflets of the mitral valve was hemorrhagic and œdematous. The spinal cord was very white, and the gray substance did not stand out in marked contrast.

Specimens for histological examination were collected from (a) hemorrhagic area along intermuscular septum, left hind leg. (b) Rounded hemorrhagic area of lymph gland in abscess on left popliteal region. (c) Hemorrhagic lymph gland from small intestine. (d) Apex of right lung. (e) Spleen. (f) Liver. (g) Kidney. These were preserved in the usual way.

Cultures taken at autopsy gave the following results:

B. equisepticus (for description see page 342) was obtained from an œdematous area of the popliteal region and from the jugular blood. *B. pyrogenes equinus* (for description see page 346) was obtained from an œdematous area of the popliteal region, an œdematous area of the left thigh, jugular blood, the peritoneum, the peritoneal gland, the spleen, the liver and the kidney.

B. coli communis was obtained from an œdematous area of the popliteal region, an œdematous area of the left thigh, from an abscess of the right hip, an abscess of the sciatic region, the peritoneum, the peritoneal gland and the spleen.

A streptococcus was obtained from the joint fluid and abscess of the right hip. Staphylococci were found in the pleural cavity and in the liver. Unidentified bacilli were found in an œdematous area of the left thigh, the peritoneum, jugular blood, lung, peritoneal gland, liver and spinal cord.

Case 10.—Blue roan filly, two years six months old. Had been sick for two or three weeks on July 24th, when first seen by Drs. Brimhall and Wesbrook. Very greatly emaciated; showed pallor of mucous membranes and great weakness in hind legs. Temperature 102.5° when seen at 7 a. m. At 7 p. m. an area over the right jugular vein was shaven, sterilized with corrosive sublimate, and by means of a large freshly boiled hypodermic syringe about 3 to 5 c. c. of blood was withdrawn, and mixed with about 50 c. c. of sterile broth in a flask and hermetically sealed.

Hæmoglobin test (Tallquist), 50 to 60; (Fleischl), 55. Red blood cells, 2,668,000; leucocytes, 422,000. Brought to laboratory—delay of 18 hours.

Examination of the blood showed great poikilocytosis. Blood smears were dried and some fresh preparations made for examinations the next day in the laboratory, but they spoiled in transit.

August 1st the colt was again examined. It did not seem any weaker. The neck was shaven, and by means of a hypodermic needle and a rubber tube and glass bulb about 5 to 10 c. c. of blood was collected and mixed with 50 c. c. of broth. The flask broke, but as much of the material as could be saved was brought to the laboratory in four pipettes, from none of which was a growth obtained. No blood count made.

Aug. 19, 1902.—On this date Mr. S. had consented to the killing of the colt, which was very much weaker and thinner than when before seen. He stated that the colt was sick a year ago, but had regained its flesh and appeared to recover during the winter. At this date it had been sick about five weeks. Emaciation was extreme, though the appetite was good. Its attitude was that of dejection, and it appeared to move with difficulty. Mucous membranes were very pale; a small ulcer on the lower lip, quite comparable to those in Cases 14 and 15 (see pages 293 and 296), was found. Temperature 103° (before collecting blood culture); 102.5° (after collecting blood culture); pulse 90 (after collecting blood culture); respiration 38 (after collecting blood culture).

At first it was decided not to kill the horse but to bring him down for demonstration before the American Veterinary Medical Association at its meeting in Minneapolis. Therefore, blood cultures and blood for microscopic and other examinations were collected as follows:

(1) Blood culture in flask, see below.
(2) Blood coagulated in test tube for Widal reaction.
(3) Blood smears for staining.

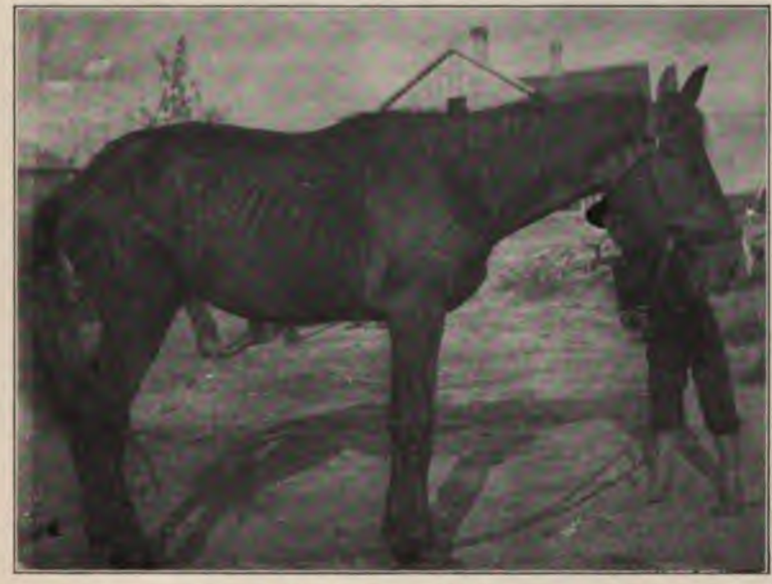
Hæmoglobin test (Tallquist), 40.

Blood count. Red blood cells, 1,252,000; leucocytes, 12,000 (counted August 21st).

At about 6 o'clock the colt had fallen down in the stall and was unable to rise; the pulse and respiration had gone up very greatly with the struggles, and it was decided to kill it.

Autopsy.—(Drs. Brimhall and Wesbrook). At 6:30 p. m. August 19th. Extreme emaciation; no subcutaneous fat; possibly a few subcutaneous hemorrhages on the right side. This may have been due to dragging through the barn.

Joints showed no swelling, hemorrhage or pus, though from the left hip joint a great deal of fluid escaped. This showed some fibrin flocculi. In the adductor muscles of both hips were hemorrhagic areas. In the extensor muscle of the right hip was an abscess about three inches long and one-half inch in diameter and



"SWAMP FEVER" CASE NO. 10.

Colt, two and one-half years old, belonging to Mr. Wm. S——-, who lives one mile north of Beltrami, Minn., and who has lost ten horses. This animal had been sick about seven weeks on the day the photograph was taken (Aug. 19, 1902). Later in the day the colt fell down, was unable to rise, and was therefore shot and an autopsy held. (See page 283.)

showing a well marked wall. Hemorrhages were present in the muscles surrounding it.

In the belly wall, between the peritoneum and the muscular coat in the neighborhood of the umbilicus, the tissues were infiltrated with pus in a flat layer, which did not communicate with the peritoneum nor open on the skin. There were hemorrhages in the same vicinity.

Thorax.—Anterior mediastinum showed masses of swollen and hemorrhagic lymph glands; pericardium filled with an amber colored fluid (about one litre).

Heart showed yellowish œdema in the auriculo-ventricular groove, following the coronary arteries. This was about two inches in width, and in the thickest portions was possibly one-half inch thick. The heart wall was anæmic, light colored, and may possibly show fatty degeneration on microscopic examination. Under the endocardium were a few small hemorrhagic areas in the left ventricle.

The pleura showed no exudate. Lungs pink throughout except for the presence of five or six small purplish, hemorrhagic areas along the lower border. There was no stippling; no pneumonia; no pus. In the cut surface some of the lobules seemed to be more or less solidified with hemorrhages, though, except for those mentioned, they did not show on the pleural surface.

Diaphragm, normal.

Abdomen.—Intense peritonitis, almost as marked as in Case 11 (see page 290). Flakes of fibrin covered all the viscera.

Coeliac axis occluded by organized thrombus surrounded by a dense mass of hard connective tissue two or three inches in diameter.

Hemorrhages of the peritoneal surface of caecum. Many small, round worms were found on the inner coat of the caecum. The lymph glands of the mesentery and those next the spleen and kidney were very greatly enlarged and hemorrhagic.

Liver very much enlarged, pale and showing an apparently acute parenchymatous hepatitis. The surface covered with flakes of fibrin adherent to the capsule.

Spleen somewhat enlarged. Covered with exudate in masses; firmer than normal and showing apparent increase of the interstitial tissue and thickness of capsule. No hemorrhages were apparent. At the apex of the spleen was an abscess, globular in shape and about two and one-half inches in diameter. This was firmly walled off from the spleen and was adherent to the peritoneum near the left kidney. Here was a large area of hemorrhage.

Kidneys were swollen, pale and resembling those in acute parenchymatous nephritis. Capsules stripped easily. There was hemorrhage in the capsule of the left kidney, contiguous to the area in the peritoneum where the abscess of the spleen impinged. On section the cortex of the kidney was very greatly increased in thickness and paler than usual.

Bladder was empty, and on the peritoneal surface of the left side showed a hemorrhagic area about one and one-half by two and one-half inches.

Tissues for histological examination were collected from (1) spleen, (2) heart muscle, (3) anterior mediastinal lymph gland, (4) liver, (5) left kidney, (6) hemorrhagic area, lung margin, (7) hemorrhagic area, adductor muscle, left hip and (8) abscess wall, right hip. These were preserved in the usual fixatives.

Direct coverslip preparations were made from (1) jugular blood, (2) peritoneal fluid, (3) pericardial fluid, (4) left hip joint fluid, (5) spleen, (6) abscess of spleen, (7) abscess belly wall.

Cultures were made from (1) jugular blood, (2) heart's blood, (3) peritoneal fluid, (4) lung, (5) liver, (6) spleen, (7) left kidney, (8) hemorrhagic lymph gland, (9) right hip joint and (10) abscess of spleen.

The cultural findings were as follows:

B. equisepticus was found in an abscess of the spleen, hip joint, heart's blood, spleen and liver. *B. pyrogenes equinus* was found in an abscess of the spleen. Staphylococci were present in the hip joint fluid. A large, Gram-staining spore-bearing bacillus was present in the spleen abscess, heart's blood, jugular blood, lung, peritoneum, peritoneal gland, spleen, liver and kidney.

Case 18.—This case was first seen by Drs. Brimhall and Wesbrook Aug. 19, 1902. The animal was a black mare four years old, stated by Mr. S. to have been sick last year when she had an abscess between the front legs. There was still thickening in this region, although in other respects the animal seemed to have made a perfect recovery, and was fat and sleek. She had, however, a marked swinging gait in her hind legs, and Mr. S. hesitated about putting her to work for fear she would "go all to pieces." He had tried to work her this year, but she seemed unable to stand it, and he feared a relapse of the disease.

From this animal blood was collected by means of an aspirating needle in the test tube, allowed to clot and the serum used for

Widal reaction. Temperature, 100.6° F. Respiration, 18. Hæmoglobin, 90 (Tallquist).

Outbreak III.

Case 6, *Mr. K., Red Lake Falls, Red Lake Co.*—Nov. 18, 1901, Drs. Brimhall and Wilson examined and collected a specimen of blood for red and white count from a mare, the property of Mr. K., living six miles southwest of Red Lake Falls, Minn. This animal had been sick but one week, and was apparently quite ill, exhibiting symptoms which the owner declared were exactly parallel to those of an animal which died about 48 hours before on the place, of supposed "swamp fever." The body of the second animal was also opened, but was found to be in an advanced state of decomposition, so that no specimens were collected therefrom.

Red cells were 9,988,000 (?) per c. c.

Outbreak IV.

Case 7, *Belgrade, Stearns Co.*—Nov. 23, 1901, Drs. Brimhall and Wilson visited the farm of Mr. Q., three miles south of Belgrade, Minn., and made an autopsy on the body of a four-year-old horse which had died 24 hours before. The animal had been hauled out of the barn to the open prairie immediately after its death. The weather was cold, and when the body was opened decomposition was scarcely noticeable. On removing the skin of the upper side of the body a few small—about one-fourth inch in diameter—hemorrhagic areas were found subcutaneously and within the fascia. A few somewhat larger areas were found between the shoulder and ribs. The lungs were markedly emphysematous, and showed in the cephalic lobes some small areas of congestion almost, if not quite, hemorrhagic. The heart wall exhibited hemorrhagic areas beautifully marked, and from one-fourth inch to three inches in diameter. The heart itself was hypertrophied.

Direct coverslip preparations, broth and serum cultures and fluids and tissues were collected from the following sources: Pericardial fluid, anterior mediastinal gland, heart's blood, lung, spleen, liver and urine.

Direct coverslip preparations from the heart's blood, lung and anterior mediastinal gland showed numerous small diplococcoid belted bacilli, indistinguishable morphologically from *B. bovisepticus*. Those from the liver and spleen showed only large square ended bacili in chains (putrefactive ?). Those from the joint fluid showed no bacteria.

Original broth and serum cultures were placed in the incubator, supposed to be kept at a temperature of 37° C., but an intense overheating of the room during the night caused the temperature to reach 41° C. No growth occurred in or on any of the cultures. They were then removed from the incubator and let stand at room temperature. When examined again after 48 hours a fair growth had developed.

It is probable that this bacillus was *B. equisepticus*, although the studies were not carried further, and the cultures died out before pathogenesis and cultural characteristics could be determined.

Outbreak V.

Case 8, *Wylie P. O., Red Lake Co.*—Through Mr. O. R., Wylie, Minn., information had been received that Mr. E. A. H., living six miles southwest of Wylie, had "swamp fever" existing among his horses, and was willing to permit an autopsy and examination of one then suffering at that time with the disease.

On January 20th Drs. Brimhall and Wesbrook visited Mr. H.'s farm, killed the animal suffering with the disease, made autopsy and took specimens.

History.—Since 1895 Mr. H. has lost in all 15 animals with this disease, including the one killed on January 20th. These animals include those raised on his own place, as well as purchased animals. Mr. H.'s buildings, which are good, though unpretentious, are situated on the side of a gentle slope, the barn being within about 100 feet of a small piece of swamp. Next the barn is a pig stye. Within 20 feet of the barn and between it and the house and about 100 feet from the swamp is the well. On the top of the slope or on the other side of it, it is impossible to obtain water within easy walking distance, according to Mr. H.'s account. The stable was well arranged and reasonably clean with a dirt floor. It showed evidence of having been recently whitewashed, and Mr. H. gave an account of the steps taken for the renovation of the stable in his efforts to get rid of the disease. The bodies of the animals which had succumbed to the disease had been disposed of by burying. The feed used consisted of native hay cut on low lying land, for the most part on another quarter section, a mile southwest of Mr. Wylie's home. It was not the coarsest quality of swamp hay, but that cut from the edges of the swamp. There was no history of the use of musty or other unsuitable food, and oats were given in abundance. All animal had been pastured for variable lengths of time. Mr. H.'s method of looking after his stock was spoken of highly by his neighbors. No history of overwork or under feeding could be obtained. There seemed to be an impression in the neighborhood that all horses obtained or bred by Mr. H. were doomed to die of "swamp fever," and he had seriously contemplated the use of oxen. The disease was present on several neighboring farms, but no one had suffered to the same extent as Mr. H.

The disease as described by Mr. H. was chronic in nature; paroxysmal fever; increase of appetite; pallor of mucous membrane; loss of weight; weakness in hind legs and tumefaction of the subcutaneous tissues between the fore legs, extending in some instances back under the abdomen. Accent was laid upon the weakness of the hind legs and areas of profuse sweating, especially over the posterior half. Mr. H. also spoke of the great thirst and profuse diuresis.

Clinical Notes.—Bay mare, about 1,200 pounds weight, aged 10 years, bred by Mr. H.—There remained in the barn only one horse (half brother to this mare), which had been bred by Mr. H., resisting infection up to the present time. The mare had been sick since midsummer, 1901. Ate voraciously and drank greedily throughout disease; some loss of flesh; staring condition of the coat; evidences of sweating over the posterior half of the body; slight pallor of the conjunctival, buccal and lingual mucous membranes was observed. Temperature 101° F. Pulse 46. The weakness in the posterior limbs was very marked, and especially noticeable in turning, when the legs became crossed. In walking the toes of the hind feet were dragged. Some slight œdema was observed.

The animal was killed by a blow on the head at 1:30 p. m. January 20th, dying without a struggle.* Immediately after falling several quarts of yellowish colored urine were voided.

Autopsy.—Subcutaneous and inter-muscular hemorrhages and œdema.

In the subcutaneous tissue between the fore legs was a hemorrhagic area showing some œdema and traces of thickening and showing traces of old hemorrhages in the yellowish or brownish color. This was possibly the remains of a large swelling which

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*The body of the animal was drawn on a stoneboat several hundred yards and Mr. H. was given specific instructions for its easy cremation. Directions were given that lime be sprinkled plentifully over the ground where the autopsy had been made.

Mr. H. said had been present some time before. Under the chest muscles was found a deeper hemorrhagic area.

In the groin was found an area showing some yellowish œdema and several lymph glands showing hemorrhagic lesions.

Joints and Bursæ.—The right hip joint was filled with a whitish seemingly purulent fluid, and showed some erosion on the acetabulum. There was some considerable fluid in the bursa of the left hock. The right shoulder joint showed considerable fluid containing a flaky precipitate. The anterior mediastinal lymph glands were hemorrhagic. The lungs showed a few small hemorrhagic areas irregularly distributed. The pleural cavity showed no excess of fluid.

Pericardium and Heart.—The pericardial sac contained about eight ounces of a sanguineous fluid. The heart showed numerous recent hemorrhagic areas scattered over both auricles and both ventricles, some of which infiltrated the muscular layer and presented under the endocardium. Over both ventricles were scattered areas of white scar tissue, irregular in outline, varying in size from a dime to a quarter. These seemed to penetrate into the muscle, and in some instances included the whole thickness of the heart wall. Some of the areas showed cicatricial depression. There were approximately ten to fifteen of these areas. The valves and aorta showed no lesions.

Diaphragm, stomach and intestines—normal. Spleen—normal in size and consistency, showing one hemorrhagic area. In close proximity to this was a slight depression looking like cicatricial retraction. Liver—enlarged, showing the marking very distinctly and seemingly bile-stained. The macroscopic appearance of the cut surface of the liver suggested at first a chronic venous congestion or "nutmeg" liver.

Kidneys showed some swelling (?), and possibly bile pigmentation, especially marked in the left kidney, which was very much enlarged. It showed a swollen cortex, and the markings were somewhat indistinct.

From the calyces was expressed a viscid, light yellowish fluid material with here and there minute colorings or streakings suggesting blood pigment. Sublumbar lymph glands, enlarged and hemorrhagic.

Bladder very greatly contracted; showed a hemorrhage in its external wall. From a cut at the urethral opening was expressed a semi-solid material of about the consistency and color of French mustard, which had a tendency to solidify on cooling. On opening the bladder, on the mucous surface were found several small hemorrhagic areas which were not visible until this semi-solid material had been scraped from the surface. The bladder contained about eight or ten ounces of this material.

Direct coverslip preparations were collected from the jugular blood, pericardial fluid, heart wall, spleen, lung, anterior mediastinal lymph gland, kidney and spinal cord. These, when stained with eosin and methylene blue, showed small colon-like bacilli.

Cultures were made from the jugular vein, coronary vein, hemorrhagic lymph glands from anterior mediastinum, groin and above kidney, from pericardial fluid, hemorrhagic areas of lung, chest and groin, from spleen, pulp, liver, kidney, clot in right iliac vein and from urine.

The following micro-organisms were obtained:*

(A) A colon-like bacillus. Morphology; motile, somewhat thick bacillus; did not stain sharply with methylene blue. Spore formation not observed.

Agar; fine, discrete, somewhat translucent grayish colonies. Serum, amber color. Fine discrete colonies, becoming confluent. Sugars. Dextrose, much reddened; saccharose, slightly reddened; lactose and maltose, unaffected. Broth, slight universal turbidity; no pellicle.

(B) Possibly a saprophytic bacillus of the proteus type; no spores observed.

Morphology. A slender bacillus slightly longer than colon, with methylene blue looking almost glass-like. Motile.

Agar; from central streak, a growth suggesting feathers, abundant, whitish, dry. Serum, dry growth, slightly liquefying. Broth, universal turbidity; pellicle. No spores observed.

(C) A bacillus about the size of type C, *B. diphtheriæ*.

Morphology. Agar, abundant, whitish rounded colonies. Serum, rounded colonies, somewhat amber colored. Sugars, no effect. Broth, universal turbidity; feebly motile. Spores overlaid end of bacillus something like symptomatic anthrax.

(D) A bacillus; irregular shapes.

Morphology. Flask, racket and other irregular rounded shapes; polar staining. Granules, irregularly disposed. Vacuoles, irregular lengths and widths. Bacilli, usually single. Agar, abundant, white growth; serum, rounded amber colonies. Sugars, dextrose, only slightly reddened. Broth, slight, universal cloudiness.

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*Owing to the difficulties in technique dependent upon the absence of platinum needles and individual swabs (10 swabs in tube) together with the fact that the broth tubes had been paraffined, and in the intense cold (35° F. below zero) the paraffined plugs stuck, a large variety of bacteria was encountered.

(E) Minute bacillus—suggests hemorrhagic septicæmia. Morphology; rounded, pale staining bacillus, suggests streptoccus; sometimes diplococci or belted form. Agar, faint growth, sometimes not visible; serum, no visible growth. Sugars, lactose, minute discrete colonies, no change in color; saccharose; minute colonies, perhaps slightly reddened. Dextrose, more abundant growth. Minute colonies; slight but distinct reddening. Broth, universal turbidity.

Summary.—Left kidney. Perhaps contained A. in nearly pure culture; possibly some D. to begin with.

Heart wall. Nothing but B. obtained.

Lung, hemorrhagic area and a white, dry, slimy-looking mould.

Pericardium. B. apparently pure.

Gland above kidney. Probably pure culture of C

Bursæ, left hock. B. mixed with a red mould.

Right shoulder. C. in purity.

Hemorrhagic lymph gland, anterior mediastinum. Apparently pure culture of E. Original culture shows a dry mould.

Deep hemorrhagic area of chest. B. apparently pure.

Superficial hemorrhagic area of chest. B.

Hemorrhagic lymph gland. C. apparently pure.

Œdematous area in groin. B. apparently pure.

Outbreak VI.

Cases 11, 12, 14, 15, 16, 17, *Beltrami, Polk Co.*—On Aug. 1, 1902, Drs. Brimhall and Wesbrook visited the "P——" farm, which is under the management of Mr. H. P., and is situated four miles south of Beltrami. The farm is low-lying, flat and covered with a thick, heavy loam and just at the barn, is somewhat wet. The floor of the barn is low, and until recently, was remarkably wet. The constantly flowing well makes it practically impossible to keep the barnyard and environments dry.

Mr. P. reported that one horse had died three weeks before. Dr. Douglas, V. S., had pronounced the case pneumonia. Two were found sick at the time of the visit of Drs. Brimhall and Wesbrook.

Case 11—*Clinical History.*—Horse—aged—bay, weight, in health, 1,500 pounds, 16 to 17 hands high. In this case there was a history of influenza, one year before, since which time there had been catarrhal discharge from the nose, and water escaped from the nose on drinking. Breathing had been noisy. When seen on August 1st, he had been sick for one week. He had eaten and drunk well, to July 31st. As he stood in the stall he appeared to be very ill, his head hanging and his breathing noisy and very labored. He was much emaciated, and could be made to move only with difficulty. His mucous membranes were pale, and there was a foul smelling nasal discharge which (foul smell) had been present for three days. His temperature was 103°. Within an hour after he was first seen by B. and W., he walked 15 feet, fell down and was unable to rise. He was shot in the forehead at 9:30 a. m., August 1st, and an autopsy held upon him.

A blood count was made from blood collected from the small vein of the nose, on August 1st, 9 a. m. and examined August 2d, 4 p. m., red blood cells, 4,224,000—leucocytes 57,000—Hæmoglobin (von Fleischl) 50 to 60—(Tallquist) 70.

Autopsy.—On removing the skin, subcutaneous hæmorrhages were few and small. Fat was almost absent. There were no abscesses encountered in any of the limbs, and no large hemorrhagic or œdematous areas found, except a hemorrhagic exudate between the muscles of the right groin. The joints were not hemorrhagic, nor purulent, although the fluid appeared to be increased, particularly in the left hock. The chest contained only a small amount of fluid, which was neither fibrinous nor hemorrhagic. The lungs were dotted with minute purplish hemorrhagic areas. The surface of the lung over these areas was not covered with fibrinous exudate. In more than one place, particularly along the anterior portions, were emphysematous blebs in both lungs. These were dark in color and contained hemorrhage in small amounts, or were next to hemorrhagic portions of lungs. The pericardium contained considerable sero-sanguineous fluid. On the anterior aspect of the heart, in the auriculo-ventricular groove was a large area of yellowish jelly-like œdema, with hemorrhagic appearance of the borders. The heart itself was somewhat pale. The mediastinium contained one or two soft purulent glands; this was the only area where pus was met with in the horse. The pleural surface of the diaphragm was covered with some fibrinous exudate, and upon its surfaces were a number of slender white worms, about two or three inches in length. These were preserved for examination (*Filaria papillosa*).

The peritoneal sac contained a considerable quantity of yellowish fluid, in which were numbers of fibrinous threads. The peritoneum and the surfaces of nearly all the viscera were covered with flakes of white lymph, or fibrin. On the liver particularly, they looked like the white crests of breaking waves. In the mesentery were numerous hemorrhages, and the lymph glands, both in the lumbar region and those attached directly to the left kidney, showed hemorrhages. Around the coeliac axis, which was occluded by an organized thrombus, was a large accumulation of connective tissue. The liver was large and dark, and covered with white flakes of lymph. The spleen was very much enlarged, covered with white flakes of lymph and contained large hemorrhages, some of them recent, and some of them apparently older. None looked to be older than a few days. The more recent looking areas resembled a purple jelly. The kidneys were large, somewhat pale, and suggested parenchymatous nephritis. The nervous system was not thoroughly examined, but in the cervical region the vertebral canal showed an area of hemorrhage and œdema external to, and present upon the dura. The interior of the spinal cord in the cervical region and the lumbar region gave no development of colonies when sown in the various media. Upon opening the nasal cavity, both nares were found to be filled with a very foul smelling accumulation of food.

Direct coverslip preparations, tissues for histological examination and material for cultures were collected from the usual sources.

The bacteriological findings were as follows:

B. equisepticus was found in the heart's blood. *B. pyrogenes equinus* was found in the joint fluid, heart's blood, pericardial fluid, lung, mediastinal gland, peritoneal gland, spleen, urine and spinal canal. *B. coli communis*, was found in the lung, liver, kidney and spinal canal. Unidentified bacilli were present in the heart's blood, pericardial fluid, lung, liver, kidney, urine and spinal canal. Staphylococci were present in the heart's blood.

Case 12.—A gray mare. This animal had been ailing for three weeks, when first seen by Drs. Brimhall and Wesbrook, Aug. 1, 1902, but seemed somewhat stronger than Horse No. 11. The mucous membranes were very pale. Blood showed hæmoglobin test of 60 (Tallquist), and gave a red count of 3,400,000 with 33,000 leucocytes. The temperature when taken was 102.5° F. By means of a specially prepared bulb hypodermic, about 5 c. c. of blood were withdrawn from the jugular vein after the area over the vein had been shaven, thoroughly washed, soaked with corrosive sublimate, and a small slit made in the skin, immediately over-lying the vein. The blood was placed immediately in a flask of broth and sealed in the blow flame. One-half the blood was put in one flask, and one-half into another.

Upon the chest and belly was an elongated œdematous swelling, about one-half inch thick and seven inches long, by three inches wide. This extended antero-posterially in the medium line. The skin over this area was shaven, sublimated and punctured with a sterile knife. From the dripping red fluid, which resembled blood, but probably contained a large amount of œdematous fluid, two sterile bulbs were filled and from them two 5 c. c. broth tubes were inoculated with about 2 c. c. each of fluid.

One of them developed *B. pyrogenes equinus* in pure culture. The other remained sterile.

The jugular blood developed *B. pyrogenes equinus* and a proteus-like bacillus.

The horse died a week later without warning, i. e., he lay down during the night and was dead at noon the next day. No word could be sent, and there was therefore no opportunity for autopsy.

Aug. 19, 1902, Drs. Brimhall and Wesbrook visited Mr. P.'s farm in response to a telegram from Mr. P., who reported that horse No. 12, had died a week after the above mentioned visit, and that he had two other sick horses which he wished examined, with a view of possibly curing them. He did not wish either one of them to be killed until he had consulted the owner.

Case 14.—This was a bay horse, 16 hands high, age 10 years. This animal had been sick about four or five days and had lost a good deal of flesh; coat was rather lusterless; temperature 102.2°; pulse 60; breathing rapid (26) and heavy; mucous membranes, pale, and one small ulcer on mucous membrane of lower lip; appetite was good, horse eating voraciously; left front leg swollen on knee and cannon. The horse seemed stiff and it was difficult to make him move. Profuse urination was noticed by Mr. P., and also by the writers. (Urinated five times in two hours.)

Jugular Blood.—Hæmoglobin, 70 (Tallquist). Red blood cells, 2,484,000; leucocytes, 9,000 (counted on August 20th). Blood was collected for the Widal reaction on aluminum foil, and blood was also aspirated from the jugular into a tube, allowed to clot and the serum collected in a pipette, for Widal reaction. (For this Widal reaction, see under "Symptoms.") Blood smears from the jugular were collected for staining; blood from the jugular was collected by means of an aspiration needle and drawn directly into a flask of broth, i. e., 5 c. c. in 50 c. c. broth.

By means of a swab, a broth culture was inoculated from the urine as it was passed naturally.

Aug. 26, 1902.—At 9 a. m. found by Drs. Brimhall and Wesbrook in the pasture unable to rise; ate as he lay; emaciation great. Ulcers on mucous membrane of lower lip five in number and increased in size over those observed on the 19th. Hemorrhagic areas on *membrana nictitans.*

Temperature 98.8. Pulse 48. Respiration 22.

Advised that the animal be killed, but Mr. P. was away from home. Photographs were taken as he lay in the field. A small artery on his nose was cut and specimens prepared as follows:

Smears for microscopic examination.

Blood for Widal in tubes open at both ends. Haemoglobin 60 (Tallquist). Blood for counting—red blood cells, 4,224,000, leucocytes 18,000; counted August 28th. At 5 p. m., Mr. P. having returned, he was killed by shooting and an autopsy made.

Autopsy.—Emaciation very great; absence of subcutaneous fat; yellowish tinge to fat-bearing connective tissue; marked areas of œdema and some hemorrhage in left groin; yellowish gelatinous œdema in left shoulder; hemorrhagic abscess outside left stifle joint; veins in sheath contained thrombi throughout.

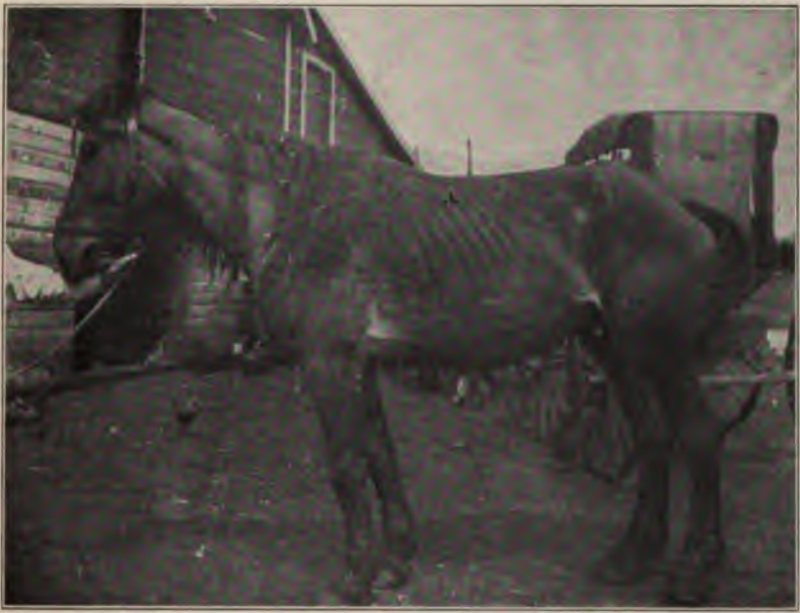
Thorax.—Pericardium contained a large quantity of fluid, amber colored.

Heart showed a large area of yellowish, jelly-like œdema in the aurico-ventricular groove with tendency to hemorrhages at the margin. Heart muscle anæmic; ventricles showed thick walls very tightly contracted containing no fluid.

Lungs showed areas dark and semi-solid, particularly along the inferior border; flaky pleurisy; no large accumulation of fluid and hemorrhagic areas were not marked.

Diaphragm showed on the peritoneal border a very great number of small hemorrhages about one-eighth to one-fourth inch in diameter.

Peritoneal Cavity.—Marked peritonitis and flakes of lymph over the surface of the viscera. The fluid was somewhat gelatinous and amber in color and did not show many flocculi. Long white worms about three inches in length and one-sixteenth to one-thirty-second of an inch in diameter were met with in the peritoneum, and preserved in formalin. In the interior of the caecum were minute, white worms about one-fourth inch long, and also larger dark worms. These were preserved in formalin also.



"SWAMP FEVER" CASE 14.

This bay horse, aged ten years, belonged to Mr. Wm. P—, who lived four miles south of Beltrami. The animal had been observed to be sick for four or five days when the photograph was taken, on Aug. 19, 1902. On Aug. 24, 1902, one week later, being down and unable to rise, he was shot, and autopsy held. (See page 293.)

Liver swollen, dark color. Flakes of lymph covered the peritoneal surface of the organ. Many branches of the portal vein showed white thrombi.

Spleen showed some coating with fibrin. The color was pale and except for a very few minute dark areas there were no macroscopic changes.

Kidneys swollen, œdematous. Capsule stripped too easily. The markings (collecting tubules) were very distinct, though the color and friability suggested parenchymatous nephritis.

Bladder greatly distended with urine, and from it a sample was secured for chemical analysis by expressing the urine through the urethra. The peritoneal surface of the large colon showed a large hemorrhagic area about two inches or more in diameter. Under the mucous surface of the floating colon were small circular hemorrhagic areas about one-fourth of an inch in diameter.

Between peritoneum and transversalis muscle in the umbilical region was a well marked hemorrhagic area one and one-half by two and one-third inches.

The horse had suffered some years before with "*poll evil*," and the ligamentum nuchæ was found infiltrated with old curdy pus and lime salts for a distance of three or four inches from its insertion into the occiput.

Special Note.—The pus over the left stifle joint in this horse was very curdy and hard, and as abscesses had been observed in various horses, the suggestion occurred that probably the œdematous areas such as those present on the same date (August 26th) in horse 15 might later become purulent, and the composition of the area vary with the age of the lesion.

Direct coverslip preparations were collected from (1) fluid of left shoulder joint, (2) abscess over left stifle joint and (3) spleen.

Tissues for histological examination were collected from (1) ulcer of mucous membrane lip, (2) hemorrhagic diaphragm, (3) clot from sheath vein, (4) liver, (5) spleen and (6) semi-solid reddish area of lung.

Cultures were made from (1) left shoulder joint, (2) abscess left stifle joint, (3) pericardium, (4) lung, (5) blood from coronary artery, (6) liver, (7) spleen, (8) left kidney, (9) urine and (10) lumbar region, spinal cord.

The results of the examination of the cultures were as follows:

B. equisepticus was isolated from an abscess of the stifle joint, from the joint fluid, from heart's blood, from pericardial fluid, from the lung, spleen, liver and kidney. *B. pyrogenes equinus* was present in the abscess of the stifle joint, lung, kidney and urine. Unidentified bacilli were present in the jugular blood, spleen and liver. Staphylococci were present in the kidney.

Case 15.—This case was seen first by Drs. Brimhall and Wesbrook, Aug. 19, 1902. The animal was a bay mare, 14 hands high, 5 years old, stocky build. Had been sick five to six days; refused to eat; first sign noticed, though appetite was good at the time of visit. Had lost some flesh, though still in fair condition; coat in good condition; sleek.

Temperature, 102°; pulse, 66; respiration, 17.

Mucous membranes not very pale; small ulcer on mucous membrane lower lip, about center, and one on tongue, lower aspect to left, and about one inch back of fraenum. Both hind legs swollen from hock down; much greater in right leg, which was also somewhat tender. Was reported to urinate more frequently than usual, though this was not observed by the writers. Hæmoglobin, 80 (Tallquist). Red blood cells, 7,264,000; leucocytes, 4,000 (counted August 20th).

Blood for Widal reaction on aluminum foil. (See page 337.)

Blood smears from jugular, for staining.

Cultures from right hock by means of aspirating needle into blood, then about 5 c. c. of the bloody fluid into 5 c. c. broth. No growth developed on incubation.

Aug. 26, 1902, the case was seen again by Drs. Brimhall and Wesbrook. Horse seemed pretty brisk, eating well and walking around in the pasture. Mr. P. stated that this horse and Case 14 remained together; docility and friendliness exhibited by desire to follow the observers around the field. Anæmia not much more marked; hemorrhage in mucous membrane of eye and on *membrana nictitans*.

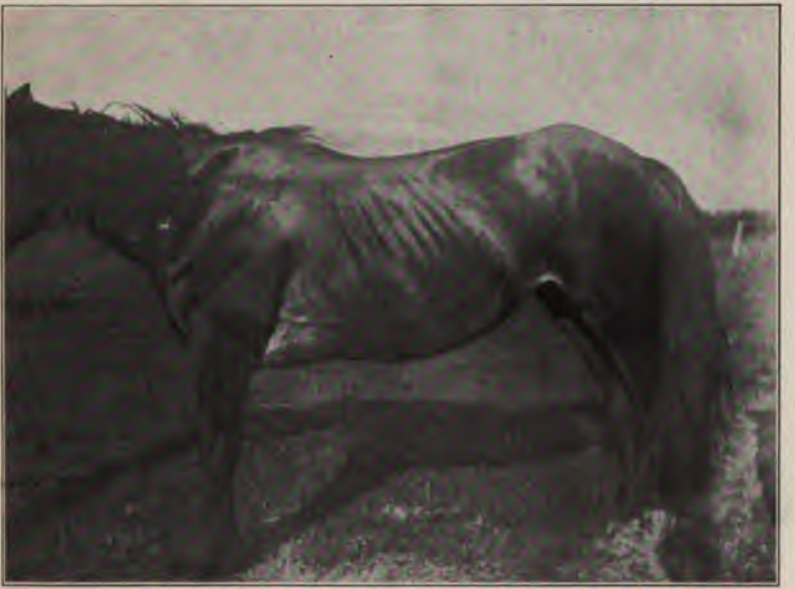
Temperature, 104.2°; pulse, 64; respiration, 20.

It appeared that the marked activity, alternating with drowsiness at times, might be accounted for by the fever present. The swelling and lameness noted on August 19th, were gone. However, there was a swelling about size of small hen's egg in the neck on the right side, near the angle of the jaw. Also a large area of œdema over cartilages of prolongation on left side. This was tender. No fluctuation.

At 5 p. m. the following specimens were collected from jugular blood.

Blood for counting, not taken—no pipette.

Blood smears for microscopic examinations showed a bacillus resembling that of hemorrhagic septicæmia.



"SWAMP FEVER" CASE NO. 15.

Bay mare fourteen hands high, five years old, belonging to Mr. Wm. P—. Had been sick for twelve days when photograph was made on August 26, 1902. Had lost a great deal in weight at this time. The emaciation progressed and later abscesses developed. On September 7, 1902, i. e., twelve days later, her owner, believing that she would not live for another week, permitted her to be shot and autopsy held. (See page 296.)

Hæmoglobin, 70 (Tallquist).

Blood for Widal reaction on aluminum foil.

Blood culture from jugular, into flask of broth; this was shaken up, and after expelling the fluid in the tube and breaking off the glass in the flame, a small amount of the mixed blood and broth was blown into a test tube, i. e., about 5 c. c. of the mixed blood and broth to the 5 c. c. of broth in the test tube. This after incubation and sowing out showed *B. equisepticus.*

By means of a flask and an aspirating needle, the swelling under the jaw, on right side was aspirated, and about 5 c. c. of a sero-purulent fluid (amber colored) was mixed with about 50 c. c. of broth in the flask. The skin over the abscess was previously shaven and sterilized with sublimate. From this flask about 1 c. c. of the mixture of broth and the fluid from the swelling was expelled into a 5 c. c. broth tube, and serum and agar cultures were made directly from the fluid itself, as it dropped from the end of the aspirating needle. Cultures from these sources showed *B. equisepticus*, which killed rabbits in less than 16 hours after intravenous inoculation of 1.5 c. c. of a 24-hour broth culture. *B. pyrogenes equinus*, was also present. Not tested for pathogenesis. *Diplococcus pneumoniæ* (?) culturally typical, was also found. Direct coverslips of this fluid made in the field, showed all three organisms in apparently the following order of frequency; (1) *B. pyrogenes equinus*; (2) *B. equisepticus*; (3) *Diplococcus pneumoniæ.*

Sept. 7, 1902, the case was seen again by Drs. Brimhall and Wesbrook, who were accompanied by Dr. Torrance of Winnipeg.

The animal was thinner and had lost flesh rapidly since time of last observation, August 26th. Though still eating well, she was weaker. The swelling noted on the neck near the angle of the right jaw at the time of last visit had opened of itself, and was discharging pus. The large œdematous area seen at the time of last visit in the left hypochondriac region, now showed fluctuation, but was not tender, as before. The ulcer on the lower lip had increased in size, was about one-half inch in diameter, and showed an indurated base with depressed center and a brownish, horny surface. The pallor of the mucous membranes was slight, i. e., about the same as before; showed a yellowish tint. No hemorrhagic areas were seen on the mucous surfaces, nor on the *membrana nictitans.* Cornea of the right eye cloudy at margin. An area of œdema was observed in the right front leg, between the knee and fetlock. Gait, slightly "wobbling;" characteristic, according to Dr. Torrance. Temperature, 104; pulse, 68; slight anæmic thrill; respiration, 40.

Owner stated that he thought she might probably live another week.

At 2 p. m., Sept. 7, 1902, she was killed by shooting in the head. Immediately the jugular vein and carotid artery were exposed and incised, and specimens collected for blood count. (The Toisson's solution used had deteriorated, and a count was found to be impossible on arriving at the laboratory.)

Hæmoglobin, 60 (Tallquist).

As the blood flowed it separated so that small masses of red appeared in the clear spaces. This had been noticed many times before by Drs. Brimhall and Wesbrook, and was looked upon as somewhat chacteristic of the disease by Dr. Torrance. The blood from the jugular, was very dark colored, and that from the carotid was of a light cherry color. Blood smears were obtained from the jugular for examination.

The skin was removed from the left side exposing swelling on the cartilages of the ribs. It was covered and surrounded by an œdematus area in which was one hemorrhagic spot about one inch in diameter. After burning over the swelling an incision was made with a sterile knife, and a broth culture inoculated from the freely escaping pus by means of a platinum needle. This abscess was about seven inches long, four inches wide and one and one-half inches thick in the center. It was found later to present in the peritoneum. An abscess was present also in the neck on the right side near the angle of the jaw. This opened on the surface and has been mentioned in the clinical notes. The abscess was sharply circumscribed and lobulated. The main cavity was rough; small blood masses in its walls; the surrounding tissues showed many petechiæ.

Emaciation was not so great in this horse as in some of the others; the cut muscles were much darker in color than had been encountered in previous experiences. Two hard, somewhat flattened rounded objects, somewhat bean-like, were removed from over the left hip. They were enclosed in a bursa-like cavity in which they were freely movable and were respectively about one-half inch and one inch long. These were preserved in formalin.

Thorax.—The contents of the anterior mediastinum seemed normal. The pleural cavity contained no marked amount of fluid, nor was any pleurisy observable.

Lungs were of a pink color and showed a few hemorrhagic areas with gelatinous infiltration. There were a few small spots of a dark purple color. Pericardium contained about 500 c. c. of a clear straw colored fluid.

Heart (weight 10½ lbs.), showed an area of yellowish, gelatinous tissue in the neighborhood of the auriculo-ventricular groove on the lower border.

Abdomen.—Some fluid containing flakes of fibrin was met with, and a flocculent coating was seen on the surface of the viscera.

Diaphragm seemed normal.

Liver (weight 19 lbs.), surface slightly coated with whitish flocculi. The organ was dark in color and showed in one area a whitish infiltration which looked somewhat neoplastic. This was irregular in shape and about three-quarters inch in diameter.

Spleen, (weight 4½ lbs.), appeared normal in color, except for small petechiæ on surface.

Kidneys. Right kidney (weight 3 lbs.); left kidney (weight 3½ lbs.). Macroscopically these kidneys appear to show parenchymatous nephritis. The capsules stripped too easily. The cut surface showed a very beefy red medullary portion, whilst the cortex appeared cloudy and swollen.

Intestines appeared normal except for the presence of some hemorrhagic areas in the large colon. Contents of stomach and intestines apparently normal. Parasites noted, *filaria papillosa*, *strongylus letracanthus* and *ascarides*, not in unusual number.

The bladder had been nearly emptied during the death struggle. The residual urine looked like yellow paint. A sample of this was brought to the laboratory and showed on chemical examination, two days later, the following:

Chemical analysis (H. C. Carel)—

Sp. Gr.	1028
Reaction	Slightly alkaline.
Albumen	Trace.
Sugar	Absent.
Urea	2 per cent.
Earthy phosphates	Normal.
Alkaline phosphates	Heavy.
Chlorides	Heavy.
Sulphates	Heavy.
Hippuric acid	0.26 per cent.

Heavy sediment consisted of calcium carbonate with a little oxalate.

Microscopic examinations made on Wednesday, Sept. 10, by Dr. E. H. Beckman, showed:

1. Oxalate urea	Very large amounts.
2. Uric acid	Very large amounts.
3. Creatin	Very large amounts.
4. Calcium oxalate	Very large amounts.

Direct coverslip preparations were collected from (1) jugular blood, (2) pericardial fluid, (3) pleural surface left lung, (4) peritoneal fluid, (5) spleen, (6) right hock, (7) abscess on left flank over cartilages connecting ribs. All of these, excepting the peritoneal fluid, showed belted, diplococcoid bacilli, found later to be *B. equisepticus.*

Tissues for histological examination were collected from (1) abscess wall left flank, (2) œdematous area heart wall, (3) spleen, (4) left kidney, (5) liver near whitish area, (6) liver including a portion of whitish area, (7) hemorrhagic lymph gland near kidney, (8) small intestine showing venous congestion. These were preserved in the usual fixatives.

Cultures were made from (1) coronary vein, (2) pericardial fluid, (3) peritoneal fluid, (4) right hock, (5) urine, (6) abscess, left flank, (7) pleural cavity, (8) posterior aspect, left lung, (9) spleen, (10) liver, (11) left kidney, and (12) hemorrhagic corpus luteum.

The results of the bacteriological findings were as follows:

B. equisepticus was isolated from an œdematous area of the jaw, abscess of right flank, joint fluid, heart's blood, jugular blood, pericardial fluid, pleural cavity, lung, peritoneum, spleen, liver and kidney. *B. pyrogenes equinus* was present in cultures from the œdema of the jaw and abscess of the right flank. *Diplococcus pneumoniæ* (?) was present in the cultures from the œdema of the jaw. Unidentified bacilli were present in the heart's blood and kidney.

Case (?) 16.—Aug. 19, 1902, this case was first seen by Drs. Brimhall and Wesbrook. The animal was a large bay horse, somewhat aged; awkward in his movements, but a good worker; broken winded. Blood was collected from this horse through an aspirating needle from the jugular vein, allowed to coagulate in a test tube, and the serum brought back to the laboratory, as a control for the Widal reaction (see page 337). He was one of a three-horse team unhitched from a binder at the time.

Sept. 7, 1902, the case was again seen by Drs. Brimhall and Wesbrook, accompanied by Dr. Torrance. The horse showed some emaciation, but was not believed to be sick by Mr. P., who was working him steadily.

Temperature, pulse and respiration seemed to be normal. Some stiffness and swelling in the hind legs, especially in one; gait awkward, but not diagnostic of the disease.*

Case (?) 17.—This case was first seen by Drs. Brimhall and Wesbrook, Aug. 19, 1902. This horse, a large bay, was also one of a three-horse team taken from the binder.

Blood was collected from the jugular vein through an aspirating needle in the same way as in horse 16, and brought to the laboratory for Widal reaction.

Sept. 7, 1902, this case was again seen by Drs. Brimhall and Wesbrook, accompanied by Dr. Torrance. Mr. P. believed the horse to be suffering from the disease, and thought it would be only a matter of time until he has also succumbed. He was somewhat thin, had rather a suggestive gait; pale mucous membranes, but no ulcers. Temperature, 101.2; pulse, 44; respiration, 48. Dr. Torrance thought this a possible case. No specimens were collected.*

Case (?) 24.—This case was first seen by Drs. Brimhall and Wesbrook, Aug. 19, 1902. The animal was a mare, black broncho, age about eight years; very spirited. Attempt was made to collect blood from jugular, in the same way as from horses 16 and 17, but she was so vicious that it had to be abandoned. This indicates the state of her health at the time of visit. No number was given her at this time.

Sept. 7, 1902, the animal was again seen by Drs. Brimhall and Wesbrook, accompanied by Dr. Torrance. Mr. P. believed this horse to be suffering from the disease. She was thinner, seemed less spirited than on the former visit; was lame in left hind leg; swelling in flexor tendons; mucous membranes pale; no ulcers.

Temperature, 103.6; pulse, 44; respiration, 38.*

Outbreak VII.

Cases 13 *and* 25, *Sauk Rapids, Minn.*—Dr. S. H. Ward, V. S., had had cases under observation, on the farm of Mr. J. B. H., whose P. O. address is Sauk Rapids, for several months. From one of these, Case 13, he had forwarded on July 31, 1902, a bulb of blood.

Sept. 12, 1902, Drs. Brimhall and Wesbrook visited the farm of Mr. H. He had lost at least seven horses in the last seven years from this disease. He had a very good farm, and everything seemed to be well conducted indeed. The buildings consisted of a brick house on one side of the road and opposite it a very comfortable frame barn. Both the house and barn are on the crest of a rolling hill. The whole farm consisted of rolling prairie with some scrub in the hollows; soil is sandy. With the exception of the possession of a flowing well, the conditions on this farm were quite different from those in the neighborhood of Beltrami, and the soil and situation of the buildings (height, etc.), were quite different. The barn was roomy; very clean; the floor was high and consisted of good, clean planking; the flowing well was on the opposite side of the road next the house, and was connected with a windmill. The only low land to which the horses had access was in the pasture, which lay in the rear of the barn. The premises were cleanly and the farm apparently very prosperous. Mr. H. also had a milk route in Sauk Rapids.

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*No further history of these animals could be obtained, and the diagnosis must remain in doubt.

The history of the disease in all instances seemed to be that of a very chronic anæmia with emaciation, the appetite remaining good throughout. Profuse urination was given as a symptom.

Case 13.—This case was first seen by Drs. Brimhall and Wesbrook Sept. 12, 1902. The animal was a roan horse, age 14; weight, 1,400 pounds; sick one year; had gradually grown thinner, though the appetite was good. From this horse, on July 29th, Dr. Ward had forwarded a bulb of blood, as before stated. Notwithstanding the specific instructions given by Dr. Ward, the horse had been shot eight hours before autopsy by the hired man, i. e., about 1 o'clock a. m. after the return from an outing. The horse had been dragged into a wheat field about 200 yards from the barn, and therefore a windbreak was erected and the autopsy made *in situ*.

Autopsy.—9:30 a. m. Body was bloated to some extent, and in the peritoneal region and over the hind legs, as well as the sternum, there was evidence of swelling. On reflecting the skin a clear, yellowish, œdematous area was encountered over the sternum; also back of the shoulder and in the perineal region there was a layer at least three inches thick of a yellowish, gelatinous œdema which had given the rounded appearance to the hips. Hemorrhagic areas were found in the adductor muscle of the hip joint and on the shin bone of the right leg in the middle third. These latter were situated deeply, and could not have been due to traumatism. Similar lesions were encountered on the shin bone of the right foreleg. The synovial fluid from the left hock was much yellower than usual. All the subcutaneous tissues were de-

Barn of Mr. J. B. H——, Sauk Rapids, Minn., situated on high, sandy ground. The house and well are in front, on the other side of a main traveled road. Mr. H—— has lost several horses, although there is only one low, marshy piece of land in all his pasture, the barn and house being on a sandy hill. (Outbreak VII. See page 301 *et seq.*)

void of fat, and had a very marked yellowish or jaundiced tint, more marked than in any case hitherto examined.

Thorax.—Anterior mediastinum showed a very marked œdema, a yellowish general coloration and small hemorrhagic areas thickly studded it all over on the left border.

Pericardium contained a large quantity of clear, very markedly yellowish fluid, which suggested very strongly bile-staining or coloration from red blood corpuscles, though there were no clots or other evidences of hemorrhage. No blood.

The anterior portion of the heart showed a very great œdema in the auriculo-ventricular groove, and extending over an area of about six inches by three inches in diameter. It was possibly one-fourth to one-half inch thick. Weight of heart, 12 pounds. Heart muscle extremely pale, showing intramuscular hemorrhages, somewhat diffuse; sharply defined lesions were in the œdematous sub-epicardial tissues overlying anterior portion of the heart. There was œdema of both mitral valves and small hemorrhagic areas in one. Summary of heart: Pericarditis, endocarditis and hemorrhagic areas.

Lungs. A considerable amount of yellowish-green fluid was found in the pleural cavity. This was slightly flocculent, and, although there was no deposit of fibrin over the surface of the lung, there was evidence of pleurisy. Lungs were normal for the most part, except on the under portion of the lobe which lay next the heart, in which there was hemorrhage and some solidification in an area about two or three inches in diameter. This was dark blue in color. From it cultures and pieces for microscopic examination were taken.

Diaphragm. Appeared normal.

Abdomen.—There was some evidence of peritonitis. A foul gas and a yellowish-green, somewhat turbid fluid, escaped into the pipette by which culture material was collected. There were some fibrinous threads on the surfaces of the liver, spleen and other organs.

Liver. Weight over 25 pounds, therefore could not be exactly weighed. Capsule was not thickened, but the liver showed a very peculiar mottling, and to the hand presented abundant small hard areas, which through the capsule and on cut section could be seen as whitish rounded masses of connective tissue. The appearance suggested a biliary cirrhosis together with fatty degeneration.

Spleen appeared normal in appearance and consistency, but was enlarged. Weight, five pounds.

Kidneys. Left kidney, weight four pounds; showed petechial spots and hemorrhagic infiltration on capsule. Capsule not thickened, and was easily stripped, showing a very pale, yellowish cortex, which was increased in thickness and suggested parenchymatous nephritis. The medullary portions were beefy red and swollen in appearance, standing out in marked contrast to the paler cortex.

Right kidney. Weight, four pounds; showed also mottling.

The renal lymphatics in both kidneys were hemorrhagic and the glands somewhat enlarged.

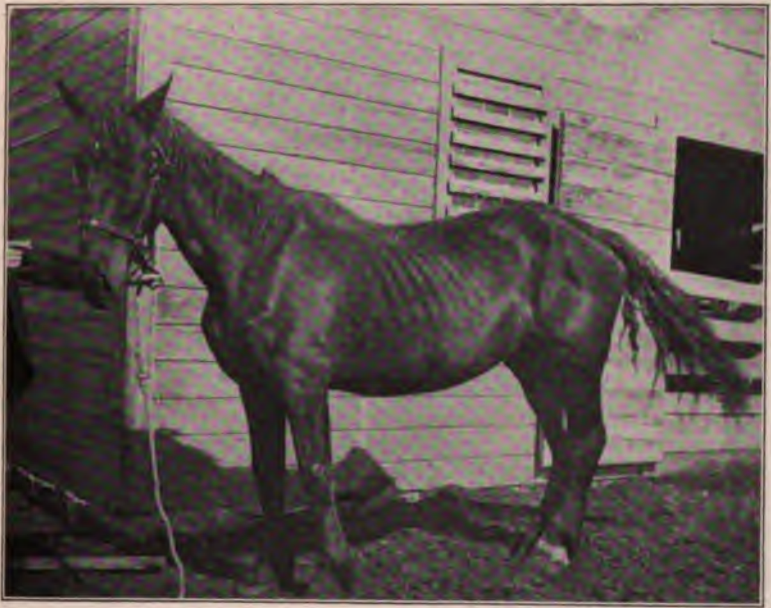
Intestines. The small intestine appeared normal. On the large colon were two areas which showed a small neoplasm, possibly one-half inch in width and one-fourth inch in thickness. These were whitish in color, irregular in outline and firm in consistency and contained small, hemorrhagic areas. These may have been tumor formation or connective tissue growth around original hemorrhage. The softening observed in one may have been due to necrosis of the old hemorrhage. The vessels of the cœliac axis in certain portions of the distribution were very greatly thickened and almost occluded by what was either an organized blood clot (most probably) or an overgrowth of the connective tissue of the intima caused by *strongylus armatus.*

Direct coverslip preparations, tissues for histological examination and cultures were collected from the usual sources in the ordinary manner.

The results of the bacteriological examination were as follows:

B. equisepticus was obtained from the joint fluid, pericardial fluid, pleural cavity and lung. *B. coli communis* was present in the peritoneum. *B. subtilis* was found in the œdematus area over the sternum. *Diplococcus pneumoniæ* (?) was present in the lung, peritoneum and kidney. Unidentified bacilli were present in the liver.

Case (?) 25.—This case was first seen by Drs. Brimhall and Wesbrook Sept. 12, 1902. Black mare, seven or eight years old; had been sick for almost a year; growing steadily thinner, though she eats well. Was used for spring work, but since then could not stand work; coat rather staring; mucous membranes very pale in eye, nose and mouth; pallor most marked of any case hitherto seen. It was stated that the horse used to sweat in patches; history of very abundant urination at infrequent intervals; the amount passed, however, seemed to be greater than



"SWAMP FEVER" CASE 25.

This black mare, aged eight years, belonged to Mr. J. B. H——, Sauk Rapids, Minn. She had been sick for nearly a year when the photograph was made, on Sept. 12, 1902, and, the decline steadily progressing, she died a few weeks later. (Outbreak VII. See page 304.)

normal. Two patches of œdema about three by six inches were noticed on each side of the median line. They were not over one-twelfth inch in thickness, however. Œdema marked in both hind legs, possibly from standing on wooden floor. Observations on pulse, respiration and temperature were made at 9 a. m.

Pulse, 55; anæmic thrill. Respiration, 14. Temperature, 101.4.

The following specimens were collected:

1. From the jugular vein about 10 c. c. of blood was drawn by means of an aspirating needle into a flat flask containing 70 c. c. of broth. This was thoroughly shaken, and about 5 c. c. of the mixture expelled through the tube, so as to rid it of the solid blood which it contained, and both tubes were sealed up in the flame. This showed no bacteria in any cultures.

2. A small amount of slightly bloody fluid, impossible of estimation, was drawn into a flat flask containing 80 c. c. of broth from the œdematous area over the sternum. Practically no fluid was obtained, and it is very probable that the culture from this source was contaminated, owing to the difficulties met with in aspiration. This showed staphylococci in direct coverslip preparations and in cultures.

3. Blood for counting. Coagulated when received in laboratory.

4. Blood for Widal reaction in double ended tube.

5. Hæmoglobin (Tallquist) was 45 to 50.

This horse died Oct. 2, 1902.

Outbreak VIII.

Cases 19, 20, 21 *and* 22, *Beltrami, Polk Co.*—Aug. 26, 1902, Drs. Brimhall and Wesbrook visited the farm of Mr. P. M. Mr. M.'s farm is situated on the west side of the G. N. Ry. track and two miles south of Beltrami. He had lived on this farm about six months, but lost horses from this disease for the last year when living north (?) of Beltrami. He gave a history of having lost six horses with this disease in the last 18 months. This farm was supplied with running water from an artesian well. The soil is a dark loam, overlying clay, and the situation of the buildings is such that drainage is practically impossible. The barn in which the horses stood was kept in a very good condition and was floored, differing in this respect from that in Outbreak VI. Last year Mr. S. lived on the farm and also lost some horses.

At the time of the visit Mr. M. had one horse (19) which seemed to be so crippled as to be useless, according to his past experience, in which he had had but one recovery (broncho). He was working two others, both of which he thought were coming down with the disease (20-21). He also had on his place Case 22, belonging to Mr. B., which he thought was afflicted with the disease, making four in all at the time of the visit, Aug. 26, 1902.

Mr. M., without suggestion, spoke of profuse urination as a frequent symptom, and Dr. Bertelson of Beltrami spoke of this being a matter of common report.

Case 19.—Seen first by Drs. Brimhall and Wesbrook on Aug. 26, 1902. Bay, white face, 14½ hands, 20 years old. Had swollen left hind leg for a number of years, but in spite of this has been a good worker. Five days ago had to stop work on account of acute swelling and lameness in this enlarged leg. Three days later some swelling and extreme lameness were noticed in the left shoulder joint. This had remained, so that at time of observation he could scarcely move. Appetite good; lost some flesh, however. Pallor of mucous membrane, peculiar yellowish tint. Ulcer of mucous membrane, lower lip. Oedematous swelling between front legs and also over left shoulder joint.

Pulse, 60 at 10 a. m. Dr. Brimhall noticed an anæmic thrill. Temperature, 102.6. Respiration, 20.

At this time he was shot, and immediately afterwards the following specimens were collected:

Blood from jugular vein.

Blood for Widal test in tubes with both ends open, plugged with cotton.

Blood smears for microscopic examination. (Jugular vein.)

Blood for counting. (Jugular vein.)

Hæmoglobin, 40 (Tallquist). Red blood cells, 1,812,000. Leucocytes, 47,000; counted Aug. 27, 1902.

Autopsy.—Peculiar yellowish tint to all fat-bearing connective tissue. Left shoulder showed œdema which was hemorrhagic in its borders. In the joint was a large quantity of fluid; over the chest was an œdematous hemorrhagic area observed during life. An abscess was observed in the sheath of the tendon of the biceps of left leg. Erosin of bicipital groove in head of humerus. The left hind leg, which had been enlarged so long showed a very hard, firm white connective tissue and perforating here and there in small bunches or nests were dilated lymphatic sinuses. The left iliac vein and branches were occluded for several inches with thrombi.

The barn of Mr. P—— M——, two miles south of Beltrami, where cases Nos. 19, 20, 21 and 22 occurred. The horses were stabled in that portion of the building reached through the door at the left hand side. The stable is located on rather low ground. The well, not shown in the picture, is further to the right and in front of the barn. (Outbreak VIII. See page 305 *et seq.*)

Thorax.—The pericardium contained a large quantity of clear, yellowish fluid.

Heart showed œdematous area over auriculo-ventricular groove. Deep in ventricular muscle were small hemorrhagic areas. Hemorrhagic areas and yellow gelatinous exudate in posterior mediastinum behind apex of heart.

Lungs did not show marked hemorrhagic areas, though there were a few purplish semi-solid patches. No visible pleurisy except roughening over patches.

Diaphragm, normal.

Abdomen.—Some yellowish fluid, slightly gelatinous in consistency and turbid, found in peritoneal sac.

Liver showed possible parenchymatous inflammation.

Spleen appeared normal except for a very few minute purplish hemorrhages (?) under capsule.

Kidneys appeared swollen and to be affected with parenchymatous nephritis. The capsules stripped too easily.

Bladder contracted and containing only a small amount of urine, though sufficient for cultural purposes and to collect a sample for chemical examination.

Direct coverslip preparations, tissues for histological examination and cultures were collected from the usual sources in the ordinary way.

The results of the bacteriological examination were as follows:

B. equisepticus was obtained from the œdema of the chest, œdema of the left shoulder joint, abscess of the biceps, from the joint fluid, from the heart's blood, from the pericardial fluid, from the spleen, liver and urine. *B. subtilis* was obtained from cultures from the œdema of the chest, œdema of the left shoulder joint, lung, spleen and kidney. *B. coli communis* was present in the cultures from the peritoneum. Streptococci were present in the abscess of the biceps.

Case (?) 20.—This case was first seen by Drs. Brimhall and Wesbrook Aug. 26, 1902. It was a horse 16½ hands, six years old. It seemed to have been out of sorts for some days. Mr. M. thought he was coming down with the disease for the past four days, though he was still working on the binder. Mucous membrane anæmic; no ulcers.

Temperature, 102. Pulse, 68.

Hæmoglobin, 80 (Tallquist). Red blood cells, 5,564,000. Leucocytes, 48,000. Counted Aug. 27, 1902.

Materials were collected for examination as follows:

1. Blood smears.
2. Blood culture into flask directly through aspirating needle; shaken up; small portion blown out into test tube. Whilst labeling, the flask broke. The broth tube, however, had been made before this time and remained sterile. (See Table II., p. 343.)
3. Blood for Widal in open tube.
4. Blood for counting.

Sept. 7, 1902, the case was seen again by Drs. Brimhall and Wesbrook, accompanied by Dr. Torrance.

Mr. M. stated that horse seemed to be recovering. The horse showed emaciation still, had a peculiar swinging gait and a little uncertainty in his walk. His coat was pretty good but "greasy" (Torrance). His hind legs were "stocked." Ulcer on the mucous membrane of the lower lip was almost healed; mucous membrane had become less blanched. Horse appeared lively.

Pulse at 12 M., 56. Respiration, 20. Temperature, 101.2.

The horse went down on Saturday evening, January 10th, and died Jan. 12, 1903, sometime in the afternoon. Dr. Annand held an autopsy Jan. 14, 1903, at 11 a. m. The body was somewhat frozen and was out in the open prairie with wind and snow blowing at the rate of 40 miles an hour—a "blizzard."

Dr. Annand secured specimens from the lung, heart, liver and spleen. The horse evidently had some form of pneumonia at the time of death, because the owner said there was a bloody serous discharge from the nostril. The heart was pale and had apparently hemorrhagic areas on the surface. The pericardial sac contained a large amount of bloody serum. The liver was pale and shrunken. The small colon had on different parts of its course hemorrhagic areas varying in size from a dollar to a space three by three inches.

The results of the bacteriological findings were as follows:

B. equisepticus was obtained from the cultures from the heart's blood. *B. subtilis* was obtained from the cultures from the heart's blood, spleen and liver. *B. coli communis* was present in the cultures from the spleen and liver.

Case (?) 21.—This case was first seen by Drs. Brimhall and Wesbrook, on Aug. 26, 1902. The horse was 10 years old, 17 hands high; a bright bay, white face. Had been ailing for ten days. However, still at light work. This horse was ordinarily very high spirited, but appeared to be apathetic at this time. The animal had been getting steadily thinner. Had weighed 1,600 pounds, but would not weigh at the time, more than 1,200 pounds.

Temperature, 105°; pulse, 70; respiration, 35, after resting one and one-half hours from work.

Hæmoglobin, 65 (Tallquist). Red blood cells, 4,576,000. Leucocytes, 51,000 (counted Aug. 27, 1902).

The mucous membrane was anæmic, one ulcer on lower lip. Was photographed, but tried to roll during the photographing showing that he had not lost all his spirit. Ate well.

Blood for culture, blood smears for microscopic examination, blood for Widal test, and blood for cell counting was collected. The blood cultures showed only *stapyhlococcus pyogenes albus.*

Sept. 7, 1902, Drs. Brimhall and Wesbrook saw this case a second time with Dr. Torrance. Mr. M. stated that the horse was better, and that he had used him for hauling hay. Mucous membranes were better color, and he appeared to be recovering. Ulcer on the lower lip had healed over, and only a slight cicatrix remained. Coat was dry and staring.

Pulse, 48 at 12 m.; respiration, 16; temperature, 100.2.

Dr. Annand saw this case, on Jan. 12, 1903, at which time his condition and appetite were good. His pulse was 43, respiration 18, and temperature 100.2. He had a slightly vacillating or staggering gait.

Case (?) 22.—This case was first seen by Drs. Brimhall and Wesbrook, Aug. 26, 1902. The animal belonged to Mr. B., of Beltrami, but was kept by Mr. M., on his farm. Roan, about 14½ hands high; age 10 years. Been out of condition for a week; getting thin; eats well. Mucous membrane anæmic; one small ulcer, lower lip.

Temperature, 103.5°; pulse, 62; respiration; hæmoglobin, 70 (Tallquist).

Specimens were obtained as follows:

Blood cultures, blood smears for microscopic examination, and blood for Widal test. The blood cultures showed no growth.

Sept. 7, 1902, Drs. Brimhall and Wesbrook, accompanied by Dr. Torrance, again saw this case. Mr. M. stated that this horse was temporarily better. Had been worked one day and driven to town. Skin in better condition than Case 21. Mucous membrane pale. Urination more profuse than usual. "Gait not characteristic" (Torrance). Hind legs swollen from hock down.

Pulse at 12 m., 48; respiration, 18; temperature, 100.2°.

Jan. 12, 1903, Dr. Annand received from Mr. M., information that this horse had been traded off to Mr. F., of Fertile, Minn., and that the animal looked very bad about a week before.

Outbreak IX.

Case 23, Beltrami, Polk Co.—Sept. 8, 1902, Drs. Brimhall, Torrance and Wesbrook visited the farm of Mr. LeF., on whose farm Case No 23, was being kept. Mr. L., lives about four miles northwest of Beltrami. The general surroundings, character of the soil, possession of flowing well, were all somewhat similar to those in Outbreaks II., VI. and VIII., and of Mr. McM.'s farm. The general topography was, perhaps, slightly different. Mr. L. lived farther west than any of the gentlemen mentioned. There was no history of the disease having appeared on his farm before.

The horse in question was one which, according to Mr. M., had been showing the disease for six months and had been traded to Mr. L. on this account. Mr. L. apparently thought the animal was not well because she was kept in a different stable from his other horses, which all appeared to be lively, and in good condition, also well cared for.

The mare was nine or ten years old, grey in color, and about 15 hands high; weight approximately, 1,100 pounds. She appeared to be not emaciated; the coat was not in bad condition; her appetite was said to be good, and she was quite lively, being quite willing to walk, or even to trot without persuasion. She had no characteristic gait.

On examination her flesh appeared very flabby, and it was said that she could not stand hard work. Mr. M., expected that she would not recover, and Mr. LeF. was expected to get rid of her. There was distinct œdema in the lower eyelid and some œdema in the legs. The membranes of the eyes and nose appeared to have a temporary hyperæmia. Dr. Torrance thought there might be some fluid in the peritoneum owing to the shape of the belly.

Temperature, 103.2; pulse, 58 with anæmic thrill; respiration, rapid, 20-22.

Red blood cells, 2,352,000; leucocytes, 7,000; hæmoglobin, 65 (Tallquist).

Direct coverslip preparations and cultures were made from the blood. The direct coverslip preparations showed no bacteria. The cultures showed a spore-bearing bacillus (probably a contamination).

On Jan. 12, 1903, Dr. Annand obtained the further information that the horse had been taken to Brainerd, where—when last seen, she seemed to be in very poor condition.

Outbreak X.

Case 26, Crookston, Polk Co.—This case was first seen by Drs. Brimhall and Beckman, Oct. 1, 1902. The horse was the property of Mr. J. V., who lives on low, level land, eight miles east of Crookston, Minn. This was a five year old black gelding, weight about 800 pounds. Had been sick about five weeks. Pulse, 84; temperature, 87.2. The mucous membranes were colorless. Emaciation was quite marked, and in backing out of the stall, it showed weakness, and a disinclination to turn short, groaning whilst turning, as though in pain. There was dullness over the lower part of the lungs. Had "wobbling" gait. The blood as taken from the facial vein was very light colored. Blood count; red cells, 798,000; leucocytes, 5,000; hæmoglobin, 20 (Tallquist).

Horse was killed by shooting, and an autopsy made at once.

The blood flowing from the large blood vessels which were cut showed a marked disinclination to clot, and was extremely pale and watery.

Nothing abnormal was found when the skin was removed. In the pleural cavity a number of large areas of hemorrhage were found on the diaphragm and the parietal pleura. These areas were made up of a collection of very small points of hemorrhage. There was about a gallon of a straw colored effusion in the pleural cavity. There was a collection of fibrin around the region of the pericardium and the fat about the pericardium was of a peculiar lemon color. There were also a few points of small hemorrhages in this. The pericardium contained about a quart of straw colored fluid. The heart, weighed 14 pounds. Heart wall showed many minute hemorrhages, both on the epicardial and endocardial surfaces. The pericardium contained about a quart of straw colored fluid. The lower lobe of the left lung was much thickened and apparently œdematous and consolidated. There were also large areas of consolidation scattered over the lower portion of the anterior lobe. In cutting through this lung it showed red and grey hepatization, and also a marked œdema in that lower portion previously mentioned. The right lung showed no œdema, but there was a considerable area which was consolidated much like the left lung. The connective tissue in the consolidated portion of the lung had a translucent yellow appearance, like rancid fat. The liver showed a number of points of adhesion on its capsule, and when cut into the hepatic vein contained organized clots. Its weight was 16 pounds. The spleen was about normal in color and consistency, although the thickness of the pulp varied greatly in different areas. About the center it was very thin. The weight of the spleen was two pounds. Left kidney weighed one and one-half pounds, and the right kidney one and three-fourth pounds. They were extremely pale throughout, there being very little difference in the color of the cortical and medullary portion. The intestines were normal with the exception of a few peritoneal adhesions.

Direct coverslip preparations, tissues for histological examination and cultures were collected from the usual sources in the ordinary manner.

The autopsy was made in a very dusty barn, while a high wind was blowing. The cultures showed a great variety of bacteria. Streptococci, *B. coli communis* and eight other kinds of bacilli were found in the cultures. These were probably mostly contaminations. *B. equisepticus* was not isolated, though in the mixed cultures, bacilli morphologically indentical with it were frequently met with. It must be remembered that the isolation of an organism like *B. equisepticus*, from cultures containing also several other species of bacilli, some of which are motile, is extremely difficult and sometimes impossible.

No further information has been received concerning other cases on Mr. V.'s farm.

Outbreak XI.

Case 27, *Litchfield, Meeker Co.*—Oct. 3, 1902, Drs. Brimhall and Beckman visited the farm of Mr. M. A. McG., ten miles south of Litchfield, Minn. Information in regard to the disease existing on this farm came from Dr. Peters, veterinarian, at Litchfield, Minn. He states that a disease similar to the present disease has existed on this place for a period of ten or twelve years, ten to twelve horses having died in that period of time. Dr. Peters says that he has seen from 30 to 50 cases of apparently the same disease in the six years that he has been in Litchfield, most of the cases being fatal.

Case 27.—This was a black mare, nine years old, weight about 1,400 pounds when in good flesh. The animal at this time was very thin. It gave a history of gradual falling away for the last four weeks or longer. It had not been worked since harvest. Appetite had been good until the last two weeks.

There were several œdematous swellings under the belly, and on both fore and hind legs.

Pulse, 80; temperature, 103.7; hæmoglobin, 35 (Tallquist).

All the mucous membranes were very pale. There were several ulcers on the lips about the tongue, and one large elevated ulcer upon the back of the mouth.

Horse was killed by shooting. The œdematous areas on the belly and on the legs contained a clear straw colored fluid. No other lesions were found in the skin and subcutaneous tissues. The pleural cavity was apparently normal, as were also the lungs. They did not collapse, but this was due to the blood which was in the trachea. The pericardium was apparently normal and contained the usual amount of fluid. The heart was large and solid, and weighed 12 pounds. It contained an infarct on its surface about one-half inch in diameter. One leaflet of the auriculo-ventricular valve was firmly adherent to the endocardial surface which probably accounted for the increase in size in the heart. The liver weighed 25 pounds; capsule was thickened, and showed evidence of old inflammatory adhesions. On section the liver tissue was yellower than normal and showed an increase of connective tissue. The spleen weighed seven pounds, was thicker and larger than normal, and in one place showed a raised area about one-half inch in diameter, which contained the normal spleen pulp, with more blood than the other portions of the spleen, which seemed to be a hemorrhage under the capsule of the spleen. There was a chronic peritonitis especially marked about the region of the cæcum. In the mesenteric artery a large organized clot was found, which contained several worms about the size of a pin, pointed at both ends, and one-half inch long, probably *strongulus armatus.* The right kidney weighed three pounds; was very pale throughout. Bladder appeared to be normal.

Direct coverslip preparations, tissues for histological examination and cultures were collected from the usual sources in the ordinary manner. On examination of the cultures, *B. equisepticus* was isolated from the spleen, liver, heart's blood and heart wall, *staphylococcus pyogenes albus* from the pericardial fluid and heart's blood, *diplococcus pneumoniæ* from the heart's blood, *bacillus subtilis* from œdema of the belly wall, *B. coli communis* from œdema of the belly wall and two unidentified bacilli, (probably contaminations), from the heart's blood, spleen, pericardial fluid, pleural fluid, heart wall and liver.

Outbreak XII.

Portage la Prairie, Canada.—Oct. 15, 1902, Drs. Brimhall and Wesbrook went to Manitoba on the invitation of the authorities to hold an autopsy upon an acute case of swamp fever at Portage la Prairie. The case died before their arrival, but too late to notify them by telegram. The carcass had already been disposed of. The farmer who owned this horse had lost 16 out of 18 horses.

Case (?) 28.—There were present at the examination and autopsy of this case Drs. Torrance and Bell of Winnipeg, Drs. Hilton and Taylor of Portage la Prairie, and Drs. Brimhall and Wesbrook of Minnesota.

Past history of horse. Bay, 10 years old; weight, 1,400 pounds. Belonged to Mr. A. H. C., who lives near Portage la Prairie. Horse had been sick two months and had done no work since seeding. He was said to have lost flesh since that time. He had been brought to Dr. Taylor one month ago with a temperature at that time of 105°. A diagnosis of malaria or swamp fever was made, and iron and arsenic prescribed with a resulting temporary improvement. No treatment had been given for two weeks.

Present condition. Oct. 18, 1902. Horse not emaciated; coat somewhat harsh, though it could not be described as staring.

Pulse, 60; temperature, 100.4 F.; respiration, 16.

Mucous membranes slightly pale. Legs slightly "stocked." No other œdema. The horse was seemingly in good spirits. Some muscular weakness with "staggering" gait.

Blood count—Facial vein, red blood cells, 6,400,000 (Bell); leucocytes not counted; hæmoglobin, 70 (Tallquist).

The case was not considered typical by the Manitoba authorities, who looked upon it as a convalescent case. Horse was killed by shooting at 2:45 p. m.

Autopsy.—Autopsy was held in a box stall upon the floor of which sawdust was sprinkled. One window was open. Considerable dust present.

Subcutaneous tissue showed some yellowish fat. Muscular tissue, dark, like Case 15. No œdematous patches except for slight infiltration below the hock. This, however, was not gelatinous and was not circumscribed.

Thorax.—Anterior mediastinum showed some enlarged hemorrhagic lymph glands. No marked œdema.

Pericardium contained about normal quantity of clear yellowish fluid. It was not blood-stained.

Heart. Weight, 8 pounds 7½ ounces. A few tiny petechiæ on the surface. Right auricle showed Zenker's waxy degeneration of one of the columnæ carnæ. There was present also a small aneurism about one-half inch in diameter. This was thin and apparently covered only with a serous covering, and projecting one-quarter inch in a conical form. It was situated within one-half inch of the degenerated muscular column.

Lungs. Normal in color and appearance with the exception of two or three small purplish areas which looked to be collapsed. No pleurisy; no excess of fluid.

Diaphragm normal, except over liver, where it was somewhat roughened. (See liver below.)

Abdomen.—There were some evidences of peritonitis, if white lymph flakes over the surface of the liver and intestines can be so considered.

Liver. Weight, 19½ pounds. Normal in color, but with large lymph flakes on surface and one roughened area four inches in diameter next to diaphragm. In the right lobe were several small calcareous concretions about one-fourth inch in diameter and rounded in shape. There were present one or two small cyst-like areas, apparently with white fibrous walls. These were not more than one-sixteenth to one-eighth inch in diameter, and it was suggested that the calcareous areas had originated as cysts. The calcareous and cystic areas were preserved for examination.

Spleen. Weight, seven pounds two and three-quarter ounces. Surface smooth and mottled. Apparently normal except for increase in size. Near the spleen and in the attached mesentery were several swollen hemorrhagic lymph glands.

Mesenteric artery showed in one area a small thrombus, and the presence of slender worms about one-half to three-quarters of an inch in length.

Intestines normal, excepting the large colon, which was covered with lymph flakes and contained one gelatinous hemorrhagic area about two inches in diameter and one inch in thickness.

Peritoneum showed small hemorrhages on lower body of surface.

Left kidney. Weight, two pounds one ounce. Right kidney weighed two pounds two and one-half ounces. Both appeared normal. The abdominal fat and omentum were bright yellow in color.

Direct coverslip preparations, tissues for histological examination and cultures were collected from eleven sources in the usual manner.

The bacteriological examination showed staphylococci from the pleura, four species of unidentified bacilli from the pleural cavity, a fifth species from the lung and a sixth from the kidney. *B. equisepticus* was not found, but it must be remembered that this case was recovering or had recovered. Cultures from eight sources remained sterile.

Outbreak XIII.

Case 29, *Winnipeg, Canada.*—Oct. 20, 1902. This case was seen by Drs. Bell, Torrance, Martin, Brimhall and Wesbrook. The horse belonged to Mr. C. Had been quite sick for two months. Two weeks before was considered a typical case of "swamp fever" by Dr. Martin, who is treating her. He thought that she was recovering October 20th. Mare, six years old, bay, weight 1,200 pounds.

Temperature, 100; pulse, 48.

Mucous membranes pale; coat shows nothing characteristic; no œdematous patches; no special weakness.

Blood count (made by Dr. Torrance), red blood cells, 5,683,000; leucocytes not counted. Hæmoglobin, 70 (Tallquist).

Blood in direct coverslip preparations for cultures and for Widal tests was collected.

The cultures showed no growth.

Outbreak XIV.

Cases 30, 31, *Russia, Polk Co.*—Thursday, Oct. 23, 1902, Drs. Brimhall and Wilson visited the farm of Mr. A. B. A., three miles east of Russia, Minn., and collected specimens from horses, Cases 30 and 31.

The locality visited is about six miles north and 3 miles east of Beltrami, Minn., the site of previous cases. It is in the Red River Valley, but near no small stream. The land is the rich black Red River soil, lacustrian in formation, and containing very little sand, being locally known as "gumbo." The house and barn were fairly well drained. The stable was dark and rather dirty. It contained 12 horses in all, four of which had been sick during the past three months. Two of these, a colt and a small gelding, were so far recovered that their temperatures were normal, and showed no symptoms whatever.

Case 30.—White mare, age 10 years, weight about 1,400 pounds. Had been sick about 12 weeks, and was apparently recovering. Temperature, 102; pulse, rate 52. The parotid glands were enlarged, though this was probably due to melanosis. The legs were badly "stocked," and there was marked œdema of the chest and belly. On closer examination the swelling on the chest was found to be due in part to an abscess. Appetite was good.

Direct coverslip preparations and broth and agar cultures were made from the abscess and the œdema of the belly wall, by shaving over the parts, washing off with alcohol and burning through with platinum spear. Hæmoglobin, 50 per cent (Tallquist).

Cultures from the œdema of the belly wall showed no growth. The broth culture from the abscess of the chest contained a small, slender, non-motile bacillus.

Case 31.—The fourth animal sick on Mr. A.'s place was a ten-year-old bay mare which had weighed when in flesh about 1,350 pounds. She had been sick about ten weeks. On the day observed she was very much emaciated and scarcely able to stand, being apparently weakest in the posterior extremities. The mucous membranes were very pale.

Pulse, 76; temperature, 102.6; red blood cells, 5,420,000; leucocytes, 4,200.

Had marked œdema over chest and abdomen and running down both fore legs. The animal was killed by shooting in the head, and an autopsy made at once.

No abscesses were found, and the œdematous areas over the chest and abdomen and over the fore legs contained only serum. Well marked hemorrhagic areas were found over the ribs under the left foreleg. Small hemorrhagic areas were found scattered over both lungs and along the line of the auriculo-ventricular groove of the heart, in the spleen and the cortex of both kidneys. There was evidence of peritonitis over the liver and small intestines. Branches of the middle mesenteric artery were thrombosed. The heart weighed 8 pounds; spleen, 5 pounds; liver, 22 pounds; right kidney, 2¼ pounds, and the left kidney 2¼ pounds.

Direct coverslip preparations, tissues for histological examination and cultures were collected from the usual sources in the ordinary manner. On examination of the cultures, *B. equisepticus* was found in the joint fluid, heart's blood, pleural cavity, lung, peritoneal gland, spleen and liver. Staphylococci and an unidentified bacillus were present in the culture from the jugular blood. *B. subtilis* was present in the culture from the œdema on the right leg.

Outbreak XV.

Cases 32, 33, *Polk Co.*—Oct. 30, 1902, Drs. Brimhall and Wilson visited the farm of Mr. A. J. A., two miles northwest of Fisher, Minn., for investigation of swamp fever. Mr. A.'s farm is in the Red River Valley, is of lacustrian formation, lies high with no swamps, and has been under cultivation since 1881. His water supply is surface wells. The horses have been in pasture, principally on clean timothy of fine quality. Six years ago Mr. A. lost one horse with what he considered the same disease as that with which his animals are now suffering. He gives the following history of this animal: Strong horse, apparently perfectly well throughout the whole of the summer. Taken suddenly ill after a day of not unusually hard work. Grew rapidly emaciated, continued so, though eating freely until he died, 61 days after the beginning of his illness.

Five years ago another horse died with similar symptoms. In the fall of 1901 two others died with the same symptoms, and during the summer three, prior to Drs. Brimhall and Wilson's visit, had died.

At the time of the visit two horses were sick. These were both examined, and are Nos. 32 and 33, swamp fever series.

Case 32.—Examined Oct. 30, 1902, by Drs. Brimhall and Wilson.

Large dark bay horse, age 10 years. Has always been strong and perfectly well until one week ago, when he grew weak behind and began to be emaciated, though his appetite remained good. To-day animal appears listless, scarcely able to walk. Was much emaciated but nibbled at food. Temperature, 104; pulse, 72 and very weak.

Case 33.—Drs. Brimhall and Wilson saw this case Oct. 30, 1902. The animal was a two-year-old bay colt. It came of good stock, and had been in perfect health until six weeks ago, when it suddenly became ill, as shown by symptoms of weakness and uncertain gait, especially in posterior extremities. Appetite remained good and animal became emaciated, and then again picked up flesh apparently. Had been able to walk on previous day, and hobbled out into the pasture about one-half mile from the house. There got down and was unable to rise. Temperature, 103; pulse, 70; extremely weak; Hæmoglobin, 40 (Tallquist).

Blood collected for counting showed later 5,800,000 red blood cells; leucocytes, 3,600.

The animal was killed by shooting and bleeding, and a post-mortem examination made at once.

The apparently good condition of the animal was found to be due to œdema over the belly and sides of the body, including the ribs. In several places, especially under the belly, the elsewhere yellowish exudate was hemorrhagic. The inguinal glands were swollen and filled with small hemorrhages.

The lungs showed most intense pleural hemorrhages which extended into the lung along the interalveolar connective tissue. So dark was this that the whole of both lungs resembled, before cutting, a lung in the acute stage of pneumonia. Incision, however, showed that it was not pneumonic.

Pericardium showed several small hemorrhages, and the pericardial fluid was increased in quantity, though clear.

The heart was enlarged, soft and flabby. Externally the heart showed but little hemorrhage, though yellow œdema was present in the auriculo-ventricular groove. On opening the left heart, the entire inner aspect of the wall was found to be covered with dark hemorrhagic areas.

The spleen was about normal in size but somewhat softened. It contained a number of pale-colored infarcts.

The liver was markedly enlarged and congested. Flakes of white, coagulated exudate from acute peritonitis covered its surface.

The pancreas showed small hemorrhages throughout the gland.

The stomach wall was slightly, and the entire intestine markedly covered with sharply defined petechial hemorrhages. An aneurism, two inches in diameter, was present on one of the branches of the middle mesenteric artery. The walls of the aneurism were about one-half inch thick, and the sac contained several small worms (*strongulus armatus ?*).

An acute parenchymatous nephritis was present in both kidneys. The cortex showed, beside diffuse inflammation, numerous hemorrhagic infarcts.

The bladder was distended with apparently normal urine.

The weight of the organs was as follows: Spleen, 5 pounds; right kidney, 3 pounds; left kidney, 3 pounds; heart, 6 pounds, and liver 24 pounds.

Direct coverslip preparations, tissues for histological examination and cultures were collected from the usual sources in the ordinary way.

B. equisepticus was isolated in the cultures from the spleen and liver. An unidentified bacillus was present in the cultures from the œdema of the belly wall and from the liver. Another unidentified bacillus was present in cultures from the lung, heart's blood and spleen.

Outbreak XVI.

Cases 34, 37 *and* 38, *St. Cloud, Stearns Co.*—Nov. 22, 1902, Drs. Brimhall and Beckman visited St. Cloud.

Mr. H.'s place, which is nine miles north of St. Cloud, formerly belonged to Judge S. Mr. H. bought the place, a farm consisting of 1,200 acres, some months ago and moved his stock down (including swamp fever cases 34-37-38) Nov. 8, 1902. All three animals were below par before he moved. The present farm is on high ground, sandy loam, and so far as its arrangements are concerned, is up-to-date in every respect.

The horses came from Mr. H.'s former farm near Hallock, Kittson Co., Minn. This place was considered better than the average in that vicinity, but the buildings were located in what appeared to be an old dry run. The probable reason for selecting this place for the stables was on account of the shelter for cattle and other animals. All of the land in this vicinity is very black, heavy soil with streaks of gumbo.

Case 34.—This case was a bay Clydesdale mare, five years old. Mr. H. says that this mare was taken sick early last spring with what he considers the same disease as the present, and was treated to repeated doses of physic and seemed to recover, remaining well until late this summer. He states that the mare was sick when brought to St. Cloud, and was brought thinking that perhaps the veterinarian there might be able to make a diagnosis and perfect a cure. Mr. H., states that in the past 14 years he has lost between 15 and 20 horses with what he believes to be the same disease, this horse being the third this summer to die. Since being brought to St. Cloud two weeks ago, the horse has been in a livery barn under the care of Dr. Ward.

The following were Dr. Ward's notes, taken on Nov. 10, 1902:

Temperature, 102.2-5; pulse, 96.

Symptoms. Anæmia, staggering gait, swelling along abdomen. Treatment. Potassium iodide and iron. No improvement in temperature or pulse. Condition remained the same, but the swelling had lessened on the 17th. The temperature on that day was 104.1-5°. There were no changes in the symptoms up to the present time, except increasing weakness.

The mare was led out into the country about two miles, into a small ravine in a pasture, and killed by being shot.

Hæmoglobin, 45 (Tallquist).

The swelling along the abdomen contained a clear straw-colored fluid.

The lungs were covered with small hemorrhagic spots about the size of a pea, and in a few places, a gelatinous straw-colored exudate mixed with blood. No hemorrhages were found on the costal pleura.

The heart contained an infarct one-half inch in diameter. Otherwise the heart muscle seemed firm and normal. The heart valves were thickened along their margin. Heart weighed eight pounds.

The pericardium contained about four ounces of dark blood-streaked fluid.

The liver was cirrhotic and felt as though the capsule contained small lumps, about the size of marbles. Weight, 28 pounds. On section the liver tissue was bile-stained, the connective tissue showed plainly, and the larger vessels were filled with organized clots. The surface of the liver, spleen, and all the abdominal visceræ was covered with small flakes of fibrin showing recent peritonitis. There were no adhesions.

Spleen was pale in color. Weight, four and one-quarter pounds.

The kidneys were apparently normal. Weight, two and one-quarter pounds each. An organized clot was found in the mesenteric artery, which contained several small worms one-half inch in length. Many worms from two to three inches in length were found attached to the inner surface of the small intestines. Mr. H. believes that these worms are always present in this disease, he having performed several autopsies upon horses dead of this disease.

Direct coverslip preparations, tissues for histological examination and cultures were collected from the usual sources in the ordinary manner.

On examination of the cultures, *B. equisepticus* was found in those from the liver, *B. subtilis* in those from the spleen, streptococci from the pleural cavity, liver and kidney, staphylococci from the joint fluid and an unidentified bacillus from the heart's blood.

Case 37.—Clydesdale gelding, four years old, shipped to laboratory while still alive. Received Feb. 5, 1903.

OBSERVATIONS ON CASE NO. 37, IN RESEARCH LABORATORY.

Date.	Hour.	Rectal Temperature.	Pulse.	Respiration.	Remarks.
2-5-03	9 a. m.	102.8			Oedema of legs and sheath. Pale mucous membrane. Loss of appetite. Polyuria.
2-6	9 a. m.	102.2	70	18	
	5 p. m.	101.6			
2-7	10:30 a. m.				Blood culture showed B. equisepticus pure. Hb. 30 (Tallquist). R.b.c. 1,414,000. Leuc. 3,000.
	11:30 a. m.	101.4			
	5:05 p. m.	103.2			
2-8	10:15 a. m.	101.6			
2-9	10:20 a. m.	100 4	90		Large oedematous patch over belly, anaemic thrill over heart.
	4:30 p. m.	103.6			
2-10	9:30 a. m.	103.2			Animal down at 3 p. m.
	4:30 p. m.	101			
2-11	10:15 a. m.	98.8			Blood culture showed B. equisepticus pure. Hb. 20-30 (Tallquist). R.b.c. 1,588,000. Leuc. 4,000. Oedema of belly wall disappeared.
	3:45 p. m.				Dead.

The animal died at 3:45 p. m., Feb. 11, 1903. No subcutaneous lesions, excepting a few small hemorrhages about the root of the tail.

Lungs.—The right lung was pale throughout, excepting a few small, clearly defined hemorrhages. The left lung was dark colored, due to hypostatic congestion, and over its surface there were many spots of yellow exudate.

The pericardium contained a very large amount of clear straw-colored fluid.

The heart muscle was firm and contained many large and small hemorrhages on both the internal and external surfaces. Heart, weight four pounds.

The diaphragm and the costal pleura contained many small hemorrhages.

The spleen was apparently normal in size and consistency, weight four pounds, and contained many clearly defined hemorrhages about the size of a pea. The liver was apparently normal. The intestines contained many hemorrhagic areas throughout their whole course. Some of the mesenteric glands were enlarged and hemorrhagic.

The right kidney, weight three and one-half pounds, was very pale, and the pelvis contained a small amount of thick yellow pus. The great mesenteric artery at the point of division from the abdominal aorta did not contain a clot, and no worms were found.

Two days before death, there was a large œdematous patch over the belly. This had entirely disappeared the day before death, and no fluid was found here at autopsy.

Direct coverslip preparations, tissues for histological examination and cultures were collected from the usual sources in the ordinary manner.

B. equisepticus was present in the cultures from the spleen and liver, streptococci in those from the heart's blood, staphylococci in those from the spleen, and an unidentified bacillus in those from the lung.

Case 38.—Feb. 7, 1903, Drs. Ward, Brimhall and Wesbrook visited Mr. H.'s farm and made an autopsy on Case 38. The animal was a Clydesdale gelding, bay, two years old last spring. Sex, male. From Dr. Ward was obtained some idea of the clinical features of the case, as observed by him. A week before the visit the temperature ran 104.5°; pulse, 55; respiration, normal. The staggering gait was very apparent; polyuria was a marked symptom; appetite had been poor; horse was described by Dr. Ward, as moping and dumpish. Considerable swelling was noticed in the hind legs; medium degree of emaciation. Mucous membrane pale.

The horse had died during the night of Feb. 6th, and was left in the stall, in the stable. At 10 a. m., Feb. 7th, he was dragged out in the open in the shelter of an old building used for housing pigs. Here the autopsy was performed. Snow covered the ground, and the weather was very cold.

Autopsy.—The chest wall was infiltrated with a clear yellowish serum, which extended from below the skin in the connective tissue between the muscles, most marked on the left side. Large hemorrhagic areas were present in the subcutaneous tissues over the left thorax. No abscesses were found. The hind legs, which had been swollen during life, were reduced in size. The left hock contained a clear yellowish synovial fluid, not abnormal in amount, and somewhat gelatinous in consistency. Seemed normal.

Thorax.—In the anterior mediastinum, was found one large hemorrhagic lymph gland.

Pleura seemed normal. No excess of fluid.

Lungs. The left lung was œdematous and showed two or three small dark areas, somewhat depressed. The right lung was pale, not œdematous; did not collapse when the chest was opened. There may have been an accumulation in the bronchi or trachea, which occurred just before death.

Pericardium contained about 300 c. c. clear amber colored fluid.

Heart wall pale throughout. No marked infiltration of the auriculo-ventricular groove, although there were small punctiform hemorrhages.

Diaphragm.—Normal.

Abdomen.—Spleen enlarged, very friable, full of blood. A few hemorrhages shown in the pale gray capsule.

Liver. Irregularly bile stained. Very full of blood and friable. The lobular markings showed well through the capsule.

Kidneys. Very pale. Small punctiform hemorrhages showing through the capsule, gave appearance of "turkey egg." Macroscopically, kidneys showed parenchymatous nephritis in cut sections.

Bladder empty.

The mesenteric artery contained a thrombus, showing the presence of a few strongyli. The peritoneal surface of the whole bowel, and the mesentery also, was stippled with small, bright hemorrhagic areas, ranging from the size of those just visible to 0.5 mm. The stomach contained a small quantity of bots and the large colon contained many of the large mature strongyli.

Direct coverslip preparations, tissues for histological examination and cultures were collected from the usual sources in the ordinary manner.

B. equisepticus was isolated from the cultures from the joint fluid, jugular blood and spleen. *B. coli communis* was present in the cultures from the heart's blood, jugular blood and kidney. Streptococci were present in cultures from the heart's blood, jugular blood and kidney. An unidentified bacillus was present in the cultures from the lung, and another in the cultures from the kidney.

Outbreak XVII.

Case 35, *Birkholz, Polk Co.*—Jan. 2, 1903, Dr. J. G. Annand brought to the laboratory in a Mason's jar, specimens removed at autopsy from a horse which had been killed for the purpose. The horse was the property of O. O., Birkholz, Heyden Twp., Polk Co., Minn., who lost six horses from "swamp fever." The animal had been sick since last summer. When seen by Dr. Davidson, of Grand Forks, two weeks ago, the animal seemed to be recovering, but on Dr. Annand's visit, December 30th, it was down, and extremely weak, though still eating everything he could reach. The animal was killed by shooting, and a post-mortem made at once.

On opening the chest, the mediastinal surfaces of both lungs were found covered with hemorrhagic areas. The surface of the liver contained a great many masses of fiber. The spleen was apparently normal. The cortex of the right kidney, showed some small hemorrhagic petechiæ. A tumor, apparently fatty, was present at the upper extremity of the ureter. A large aneurism was present on the middle mesenteric artery. There were no abscesses.

Portions of the lung, heart, spleen, liver, kidney, and the aneurism from the mesenteric artery were brought to the laboratory (a worm had been observed in this aneurism when opened in the field by Dr. Annand).

Cultures were made in broth and on serum from the heart, lung, spleen, liver and kidney. After 24 hours in the incubator, no growth was present on those from the heart and lung. Cultures from the spleen showed a small, diplococcoid belted bacillus which subsequent cultures showed to be *B. equisepticus*. In addition, there was present, a long, thick, spore-bearing motile bacillus of a bright yellow growth on agar. Cultures from the liver showed only *B. equisepticus*. Cultures from the kidney showed a large diplococcus.

Outbreak XVIII.

Case 36, *Birkholz, Polk Co.*—Jan. 1, 1903, there was received in the laboratory from Dr. J. G. Annand, in a quart Mason's jar, specimens removed at autopsy from a horse which had been killed for the purpose. Animal was the property of Mr. John D., resident of Sandville Twp., Polk County. The horse had been sick six months. On Dr. Annand's visit December 30th, he was found to be thin in flesh, much debilitated, but able to move around; was killed by shooting and an autopsy made at once.

A marked hemorrhagic area was found in the superficial muscular tissue of the superior lumbar region. The mediastinal surfaces of both lungs showed hemorrhagic areas. The heart showed no lesions. The spleen showed large and small hemorrhagic areas on its surface. The surface of the liver was covered with fibrin. The kidneys both showed small hemorrhagic areas in the cortex. The artery supplying the large colon contained a small aneurism, which was extremely hard. Another aneurism was present in the mesenteric artery supplying the upper portion of the small intestine.

Specimens had been kept cold, just above freezing point, from the time of their removal, until brought to the laboratory. They were then placed out-of-doors in a temperature of about 20° F. above zero, and on the following morning were found slightly frozen.

Cultures were made from the lung, heart, spleen liver. Those from the lung after 24 hours in the incubator, showed a large diplococcus, and a small diplococcoid belted bacillus, which subsequent cultures showed to be *B. equisepticus.* Those from the heart wall showed no growth. Those from the spleen showed a small diplococcoid belted bacillus which subsequent culture showed to be *B. equisepticus.* Those from the liver gave a short thick oval spore-bearing, non-motile bacillus, having a wrinkled growth on agar, and a large, long, thick, motile bacillus, non-spore-bearing, having a wrinkled growth on agar.

It would appear from the cultures that the only significant bacteria present were *B. equisepticus*, from the lung and spleen—with the possible exception of the diplococcus from the lung— the large bacilli from the liver being probably contaminations.

GENERAL DESCRIPTION OF "SWAMP FEVER" AS OBSERVED IN CASES INVESTIGATED BY THE MINNESOTA STATE BOARD OF HEALTH.

As will be seen from the foregoing detailed statements concerning investigations, a large number of cases of this disease have been seen since the autumn of 1901.

The distribution of these cases may be ascertained from the accompanying map, which shows what may be termed two foci of infection, one in the valleys of the Red and Red Lake rivers, and the other in an area included in Stearns, Meeker and Benton counties.

Whether cases have occurred, to any marked degree, in other localities in the state cannot be definitely stated. From all the information which could be obtained from owners of stock, veterinarians and other interested observers, it would appear that in the northern focus cases have been noted by different individuals for from 2 to 18 or 20 years. The owner of cases Nos. 34, 37 and 38, Outbreak No. XVI., formerly lived near Hallock, Kittson county, which is not far from the Manitoba border line. He believes that he has been losing cases from this disease for the past 14 or 15 years. He moved to the middle portion of the state near St. Cloud in 1902, and the three cases, Nos. 34, 37 and 38, reported in these investigations, were apparently suffering from the disease before he brought them south, so that they cannot be rightly considered in relationship to the southern focus. Dr. Longevin, V. S., of Crookston, Minn., states that he has had cases, which do not differ materially from certain of those studied during this investigation, under his observation for the past 20 years. Many of the stock owners in the vicinity of Beltrami report their losses from this disease as extending over a period of from 2 to 10 years.

In the southern focus of infection it has been impossible to obtain an accurate history which would indicate that this disease has been long recognized.

1. **Local Conditions in Relation to Outbreaks.**—In the northern focus of infection the conditions obtaining on the individual farms are fairly comparable. The soil is a heavy black loam, of the lacustrian formation characteristic of the banks of the Red River and its tributaries. The country is markedly flat, and there is little natural drainage. Where flowing wells are present, the land in their vicinity is frequently boggy, owing to the impossibility of drainage, as the drains frequently freeze solid in the winter, and in the early spring there are vast quantities of ice which, when melted, result in the formation of small lakes or ponds in the neighborhood of the stables. Wherever there is a slight dip in the land, water stands for a large portion of the year and swamp hay grows in abundance. There are certain minor exceptions to this general condition in a few of the farms. The farm on which Outbreak II. occurred consists for the most part of this typical loam, being very flat. Across the southeast corner, however, the Sand River flows,

and there is a well marked gravel and sand ridge. One farm* on which from June, 1901, to May, 1903, 10 horses had succumbed to the disease, was five miles north of Fisher, Minn. This farm occupies ground which was apparently an island when the surrounding country was covered with water. The ground is rolling and covered with large trees in marked contrast to most of the Red River Valley. It is well drained. The soil is a rich black loam, similar to that of the remainder of the Red River Valley.

The southern focus of infection does not cover a solid block of territory, as is the case in the northern focus. In fact, this disease has been observed only in three localities near St. Cloud, Litchfield and Belgrade. There is nothing to show that this triangular territory, of which the three localities named are the angles, is generally infected, as is the case in the northern focus. Near St. Cloud (Outbreak VII.) the country is rolling, with an exceptionally light, sandy soil, in many place well wooded. In certain districts granite underlies the sand. On the farm on which Outbreak VII. occurred the buildings were situated on a sandy hill, and there was only one small swampy pasture on the farm.

Near Litchfield there is very light sandy soil. It is very rolling, and on the farm where Outbreak XI. occurred, there were alternating steep hills and valleys, some of the latter containing water. Dr. Peters, V. S., believes that in this vicinity 50 or 60 cases of swamp fever have occurred during the last 10 years.

In the vicinity of Belgrade the land is low-lying and swampy. A large portion of it is covered with scrub oak and alders, interspersed here and there with tamarac. On the farm in which Outbreak IV. occurred there was one swamp which covered several acres.

It will be seen that in both the northern and southern foci feeding from low-lying ground or the use of coarse hay cut from low places cannot be excluded, although observations have not tended thus far to show conclusively the relationship between this and the disease.

The source of the water supply varied considerably, that in the northern focus being derived frequently from flowing wells or from surface wells sunk some distance through the black loam and clay. In certain of the farms of the southern territory the wells have been sunk through sand. The possibility of horses in pasture obtaining the water from pools, marshes or lakes cannot be excluded. Suspicion attached in many of the outbreaks to the water and feed, and the owners of affected stock were always desirous of having these thoroughly investigated.

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*Although the disease on this farm was studied, since no laboratory material was collected, the outbreak was not numbered and catalogued with the others.

The housing of horses was fairly good in most cases, and exceptionally good in many. Certain of the horse stables, however, particularly in the northern focus, were without floors, and at certain seasons of the year, therefore, decidedly damp, the mixture of manure and black loam tending to retain moisture for a long time. Certain of the stables are constructed of logs. The animals in most cases were more likely to suffer from heat in the summer than from cold in the winter.

2. **Season.**—It is felt that insufficient data is at present at hand to make any definite statement in relation to the time of year when infection takes place, although it would appear that the first symptoms were observed by owners of stock during the summer months. The cases seemed to begin in the early summer months, and to increase in number during the months of July and August, after which relatively few were noticed to develop. A few cases have been reported and also examined during the winter months, but in these the history given showed that the animal had been suffering from the disease since the preceding summer. These observations coincide with those in the Manitoba cases. The observations in this state and Manitoba, however, do not tend to show conclusively the time at which infection takes place, since the disease is usually insidious in its onset, and sometimes assumes a very chronic type. If it be true that infection takes place during the summer months, the possible relationship of insects or arachnids to the spread of the disease must be considered along with temperature, etc., as a factor in aiding saprophytic development of parasitic bacteria. It is at this season of the year when horses are likely to be overworked, and when there is a greater variation in the food supply than during the winter, both of which factors may have some effect on their resistance to infection. The relationship of season, if found to be constant, may have some other explanation than can be afforded by any of the suggestions hitherto advanced. A parasitic theory was and is still tempting, but the results of the Manitoba investigations and the earlier examinations in the work of this board, which seemed to exclude blood parasites, together with the positive demonstration in practically all cases in which a satisfactory examination was possible, of *B. equisepticus*, and in

Barn of Mr. M., who lives three miles southwest of Beltrami, and who reports the loss of six horses from "swamp fever." No material was collected for laboratory study.

certain instances of *B. pyrogenes equinus*, served to direct attention away from animal parasites to a bacterial cause. Why horses should be more susceptible to *B. equisepticus* or other micro-organisms during the summer months is not easy of explanation, unless temperature and other conditions tend towards their more abundant saprophytic development, are less destructive of the life of the organism, or that the horses themselves are rendered by the nature and variety of the summer feed, possible overwork and the high temperature of their environment, less resistant to infection.

3. **Onset and Course of Disease and Mortality.**—From the observations in Minnesota, as well as those reported in Manitoba, it would appear that this disease is, as a rule, rather insidious in its onset. Frequently a history is given, which shows that the affected animal has been "out of sorts" for some weeks. Sometimes for a day or two the horse may have refused food, though this is not constant. A general weakness, very gradual in development, loss of flesh, periods of fever, followed by times of apyrexia, gradual emaciation, staring coat, a ravenous appetite, and in some instances polyuria, constitute the train of symptoms. In Minnesota a rather common history, however, is that the owner of the animal has noticed very little wrong, and may have been working him all the time, although he has noticed gradual loss of condition with periods of apathy. These periods of apathy bear some relationship to the occurrence of the fever, i. e., as noticed by the owner they probably correspond to the periods of apyrexia. In one instance a horse, apparently in the beginning of the disease, working on a binder, was found to have a temperature of 105° F.

The duration of the disease varies. In some instances symptoms are noted by the owner only for a period of from one to four weeks before the death of the animal. This is apparently the exception in Minnesota, although in the horses seen during this investigation it was met with frequently. The owners of horses are inclined to dwell upon the chronicity of the disease, and to believe that they may apparently recover and some months later succumb.

Certain of the cases seen,—particularly Cases 11 and 12, Outbreak VI.—were sick only from one to two weeks, according to the observations of the owner, whereas others (Cases 13 and 25, Outbreak VII., Cases 34, 37 and 38, Outbreak XVI.) had been observed to be suffering from the disease for several months.

In those cases in which symptoms have been observed for only a few days, it is perhaps unsafe to assume that infection occurred immediately before the first symptoms were observed, unless observations have been made by a competent veterinarian.

In the endeavor to ascertain the mortality of the disease in t state, circulars were sent out to all the owners who were known this board to have lost heavily from the disease. From these c culars, and from information collected from time to time, it ha been found impossible to state definitely what the mortality is since the diagnosis of many cases must remain in doubt, where information was received through horse owners and not through veterinarians.

In the neighborhood of Beltrami, over a section about two miles wide by six miles long, 26 farmers have reported the loss of 136 horses from this disease. From 12 other owners of horses the loss of 75 animals from swamp fever has been reported, which makes a total of 211 animals lost from this disease on 38 farms. From the experience at Beltrami, which neighborhood was more thoroughly studied than any other, it would seem that close investigation in other localities would reveal a similar condition of affairs. From all available data the mortality in Minnesota would appear to be in the neighborhood of 80 per cent.

Many of the owners who have lost heavily from this disease believe that a horse once affected will never recover, and where animals have apparently regained their normal condition, they are afraid to put them to hard work again.

4. Age, Sex, Character of Animals Affected.—From the details which have been given concerning the outbreaks, as also from the table of symptoms which is given under the following paragraph, it will be seen that horses of all ages and both sexes are affected by this disease. Farm horses, driving horses and colts running at large have all been found infected. Well bred horses from eastern stock, those brought from other localities and those raised on the infected farms have all succumbed to the disease. By some stock owners bronchos were thought to be immune, but this does not appear to be the case. No cases have been observed in mules or asses.

5. Symptoms.—The occurrence of so many cases of this disease in somewhat inaccessible portions of the state rendered continuous clinical observations by the veterinarians of this board impossible. In the earlier cases studied it was hoped that the establishment of a branch laboratory in the infected district near Beltrami would be possible, and that cases could be kept under daily observation

Outbreak No.	Case No.
II	2
II	3
III	6
IV	7
V	8
II	9
II	10
VI	11
VI	12
VII	13
VI	14
VI	15
VI	16
VI	17
II	18
VIII	19
VIII	20
VIII	21
VIII	22
IX	23
VI	24
VII	25
X	26
XI	27
XII	28
XIII	29
XIV	30
XIV	31
XV	32
XV	33
XVI	34
XVII	35
XVIII	36
XVI	37
XVI	38

for several weeks. This was found impracticable, owing to the amount of bacteriological work involved in the examination of specimens collected at autopsy. The working out of these kept the whole laboratory force employed, since the material brought in from one autopsy frequently required several days or even weeks for its satisfactory classification and initial study.

As has been stated before, it had been planned to bring infected cases to the Laboratory of Animal Research, where they might be kept under daily observation, but for the reasons already given this was found impossible, except in Case No. 37, which died five days after arrival.

The following table gives some idea of the symptoms observed in the different outbreaks, as well as certain data concerning local conditions, duration of disease, age, sex, etc., to which reference has been made already.

One of the most marked symptoms of this disease is the *gradual loss of condition.* The hair becomes staring, and gradual emaciation develops. In a few cases the appetite was noted to diminish with the onset of symptoms, but in most instances this was not noticed. Loss of condition, extreme emaciation and progressive weakness in the limbs was all the more remarkable in consideration of the voracious appetite usually noted. The appetite usually continued, irrespective of the quality of the food, and whether the horse was working or not. An illustration of it is afforded by Case 10, Outbreak II., in which this colt reached out to nibble at the grass and weeds as it was being dragged away on a "stone boat" to be killed for autopsy, it being too weak to walk. As the disease progresses a staggering or "wobbling" gait is noted. This is particularly apparent in the hind legs when the horse is turned short. This symptom persists, and in cases which are apparently recovering may be noted for a long time. In a number of the animals examined thrombi in the iliac arteries were observed, although it would not appear that this condition was responsible for the gait. Where the horse had been suffering from the disease for several weeks, swelling of the legs was noticed, and in many of the cases the joint fluids were increased and a marked tenderness over the joints observed. In one animal, Case 19, Outbreak VIII., there was a very marked puffiness and œdema of the left shoulder joint, and at autopsy a small abscess of the tendon sheath with erosin of the bicipital groove was found. Patches of œdema developed on the thorax and abdomen of the horses, particularly in the last stages of the disease. In fact, the œdematous areas developed very frequently in the most dependent portions, and were encountered in horses which had been unable to rise for any considerable time. In certain instances areas which had been at one time œdematous, were later found to be purulent. (See Case 15, Outbreak VI.)

The occurrence of abscesses was not at all constant. Their presence was noticed in Outbreaks II., V., VI., VIII. and XIII. They varied considerably in size. In certain of the animals seen during this investigation, sweating appeared to be very marked, although not necessarily uniform over the whole surface of the body. (See Case 8, Outbreak V.)

Polyuria.—Polyuria in many cases had been observed by the owners, and was particularly marked in Case 14, Outbreak VI.; Case 13, Outbreak VII.; and Case 26, Outbreak X. In case 14, Outbreak VI., the animal urinated four or five times in two hours.

Satisfactory chemical and microscopic examination of the urine was impossible, owing to the distance of the infected localities from the laboratory and the changes which took place during transportation. (See Cases 14 and 15, Outbreak VI., and Case 19, Outbreak VIII.)

Albumin was found scanty or absent. No red blood cells, pus or casts were seen.

Respiration.—The respiration was increased in frequency, especially upon exertion, and when there was great weakness. Many of the observations were made just prior to the killing of the animals for autopsy, and no very definite statement therefore can be made concerning respiration, temperature or pulse, since these cases were so far advanced.

Temperature.—The temperature varied, and there appeared to be periods when fever lasted for several days, followed by periods of apyrexia. In the investigations by this board the temperature varied between 100.2° and 105° F. In Manitoba the temperature is reported as "variable, running high for a few days, then falling almost to normal for several days, then rising again, but towards the latter stage of fatal cases remaining persistently high." A definite *periodicity* of the fever comparable with malaria has not been noted. During the febrile attacks the animals frequently seemed to be quite spirited, and the owners thought they were recovering. In the apyrexic periods they were listless and depressed.

Pulse.—The pulse was increased in frequency as a rule, particularly when weakness was marked or the temperature high.

Dr. Torrance calls attention to "the particular thrill as if the blood vessels were only partially filled," in his observations on the disease in Manitoba, in which an especially good account of the symptoms and course of the disease is given.

Anæmia.—The mucous membranes of the mouth and eye soon develop a pallor which in advanced cases becomes extreme. Hemorrhages have been noted, but rarely on exposed mucous membranes. In several cases ulcers were found on the tongue or lip, but there is nothing to show that these served as the original foci of infection. The blood is usually pale in color, even to the naked eye, and undergoes coagulation rapidly, except in very advanced cases. The hæmoglobin, as determined by Tallquist's method, varies from 20 to 80 per cent. In some of the acute cases the low percentage of hæmoglobin was not very apparent (Case 15, Outbreak VI.). In Case 11, Outbreak VI., where the sickness of the animal had been noticed only one week, the hæmoglobin percentage was 70.

The blood, when smeared on coverslips, quickly separated so as to show alternating red and light colored areas. This seemed somewhat characteristic.

The number of red blood cells was found to vary within rather wide limits, the lowest counts being in the neighborhood of 1,000,000 per c. mm. With the progress of the disease there was a very great decrease in the red blood cells, accompanid by a loss in the hæmoglobin percentage. The leucocyte count was found to be variable, ranging from 3,600 to 60,000. In most instances where the leucocytes were present in great number, there were localized collections of pus, although this relationship was not shown to be constant. In connection with the red blood cell and leucocyte count, it should be mentioned that blood was mixed with Toisson's solution and the filled pipette taken to the laboratory for examination, so that in some instances 24 to 48 hours elapsed between the collection of the specimen and the count. In Case 37, Outbreak XVI., and Case 29, Outbreak XIII., the counts were made immediately.

6. Morbid Anatomy and Pathology.—In these investigations a thorough study of the morbid anatomy (including) histology of the disease had been planned. The positive bacteriological results obtained in the early cases involved an amount of laboratory work scarcely credible. On account of the necessity for the collection of material in the field and the advanced stages of associated conditions, such as abscesses, etc., a very great deal of work in the isolation and identification of a multitude of bacteria was necessary. Thorough and satisfactory work was somewhat impeded by the fact that during July, August and September, 1902, owing to the interest aroused and the large number of cases reported, it became necessary to perform a great number of autopsies and to work out the bacteriology within a very short time. The distances to be traveled were also great. As has been already stated, from all cases materials were collected from the sources noted and fixed for histological study. Some of these tissues have been worked up, but it is felt that insufficient data has been yielded as yet to warrant any attempt at detailed report or the drawing of conclusions.

The necessity for making a final report upon infectious diseases of animals at this time requires this board to make a report to date on "Swamp Fever," although anything in the nature of an exhaustive report had not been contemplated until completion of the work, including thorough pathological and experimental study. It is hoped that opportunity may be afforded in the future to work up all the pathological material now on hand, when a further report or paper may be expected.

A general idea of the pathological findings met with may perhaps be best obtained by first discussing the kinds of lesions and their location, with a later summary under the individual systems or organs.

The hair appeared staring and coarse. Emaciation was great, and some difficulty in the skinning of the animal was therefore experienced. The subcutaneous fat was very scanty, and usually had a marked yellow tint, suggesting jaundice. This peculiar yellow tint was characteristic of the fat found throughout the body, and in a number of instances the fluids met with in the serous cavities were of the same color. In many animals sharply outlined œdematus patches were present, underlying the skin in the dependent portions of the body, as described under symptoms. The most common sites were on the chest, extending back upon the abdomen (see Cases Nos. 12-25 and others), and were found in the subcutaneous tissue of the legs. In those cases in which the animals had been down for some time, the œdema often appeared upon the side on which they had rested (see Case No. 15). In some cases there was good evidence to show that such subcutataneous œdematous areas later became purulent (see Case No. 15 and experimental horse No. 4). Such œdematous areas, variable in extent and generally yellowish in color and gelatinous in consistency, were met with between the chest muscles and those of the legs, and frequently surrounded abscesses when such were present. In the mediastinum they were also seen, and in the auriculo-ventricular groove on the ventral surface of the heart they were often found in advanced cases. In many instances, scattered throughout the gelatinous œdema or impinging on the border of it, hemorrhages varying in color (dirty yellow, bright red or almost black) were seen.

On removing the skin its lower layers, as also the subcutaneous connective tissue, showed in almost all cases hemorrhages varying in size from petechiæ to irregular spots two and three inches in diameter. These hemorrhages occurred not only in the skin and subcutaneous tissue, but between and into the muscles and fasciæ, the synovial sacs, in the lymph glands, in the mediastinum, upon the serous surfaces of the heart, lungs and peritoneum, sometimes involving the heart wall to such an extent that large red areas were visible under the pericardium, continued through the muscle and appeared under the endocardium.

The lung was sometimes stippled with red spots, showing through the pleura. At other times, irregular areas of hemorrhage occurred, which completely filled several contiguous lobules.

The spleen in a few instances seemed almost entirely devoid of hemorrhages, although, as a rule, it was found spotted with irregular red blotches, and in certain of the cases examined, well marked, extensive infarcts were to be seen.

The kidneys occasionally presented a "turkey egg" appearance, but in some cases large, well marked hemorrhages were seen beneath the capsule, and in some of the organs in which parenchymatous nephritis was well developed extensive microscopic hemorrhages were found between the straight and collecting tubules.

The mesenteric and intestinal wall, including stomach, quite frequently showed hemorrhagic areas, in some cases several inches in diameter. These were frequently sub-peritoneal, but in a number of instances involved the whole gut wall, including mucosa.

As has been stated, hemorrhages were sometimes found in the gelatinous œdema. Blood clots variable in color were found in abscesses, and occurred in inflammation and thickened tissues around the abscesses, as also around joints in which inflammation was well developed.

It is impossible to state accurately at what stage of the disease hemorrhages are most likely to occur, although it would appear that they were more common in advanced cases when the blood changes were most marked.

As will have been seen from Table I., abscesses were quite frequently met with in those cases in which an autopsy was made. The occurrence of abscesses in the Manitoba cases would appear to be somewhat infrequent, and perhaps that is true also of those in Minnesota, although a somewhat different impression may be given from the records of this investigation. Abscesses were found in such sites as lymphatic glands, around and involving joints and tendon sheaths, patches of subcutaneous œdema which had later become purulent, and in some cases, particularly those examined in Outbreak II., the destruction of tissue was very widespread. In one animal, Case No. 9, a huge abscess, involving the hip joint, extended along the course of the iliac vessels, which were thrombosed, and presented beneath the peritoneum. Hemorrhages occurred in the wall of the abscess, and a yellow gelatinous œdema was found surrounding it in certain places, particularly in the tissue beneath the peritoneum and overlying the abscess, where it was over an inch deep. The pus usually was light in color and fluid, although in certain instances, owing to the presence of hemorrhages and clots, this appearance was not always observed. In one instance an abscess, the size of a small orange and well walled off with fibrous tissue, involved the apex of the spleen.

In some instances the lungs showed purulent areas.

Inflammation of the serous surfaces was so common as to be recorded as characteristic of this disease. Some one or more joints were found affected in nearly every animal. Excess of fluid with some thickening of the synovial sac was the least marked of these joint affections. Very often the fluid was found increased in amount and containing fibrinous flocculi, with roughening the inner joint surface, and in some instances blood clots were also seen. In few cases was a purulent synovitis seen, unless abscess formation involving the tissues around the joint was also present.

The pleural cavity usually showed some increase of fluid, and in a few cases the exudate was fibrinous. This was not common, however.

In the pericardium a similar condition of affairs was seen.

In the peritoneum well marked inflammation was quite frequently met with, and fibrinous flakes were often found upon the various abdominal viscera. In some cases the amount of fluid was enormous, and it was turbid with fibrinous flakes, so as to be semi-purulent. In certain of these cases long thread-like worms, *filaria papillosa*, (*Rudolphi*), were found free in the peritoneal cavity.

Connective tissue replacement was observed in the areas which had been apparently occupied by pre-existing hemorrhages. These were especially noticeable in the heart of Case No. 8, where the organ was studded with fresh hemorrhages and retracted connective tissue patches, in some cases involving the whole thickness of the heart wall. This connective tissue development was also seen in those spleens in which infarcts had occurred, and was found in and surrounding the vessel walls where thrombosis had existed for some time. This latter has probably no connection, however, with this disease, as most of the thromboses met with were verminous in origin (*strongylus armatus*).

Blood.—Marked anæmia with diminution of red blood cells and lessened hæmoglobin percentage. Leucocyte counts variable, although usually increased over normal. Specific gravity and reaction of the blood undetermined.

Coagulability usually good, except in very advanced cases. The occurrence of chicken fat clots or coagulation peculiarities cannot be stated, since in most instances horses were killed by shooting or bleeding and the autopsy held immediately. Where blood was collected for cultural or other purposes it was usually found to coagulate very firmly and rapidly, even when a small quantity of blood was mixed with a large quantity of broth. In very anæmic subjects the occurrence of many hemorrhages, as noted above, was conspicuous.

Widal Reaction.—Upon the demonstration of *B. equisepticus* and *B. pyrogenes equinus* in the tissues and fluids of "swamp fever" horses a series of investigations was made to ascertain if the blood of such horses would cause "agglutination" of either one of these microörganisms.

For *B. equisepticus* negative results were obtained in all dilutions. With *B. pyrogenes equinus* agglutination and arrest of motion occurred even in high dilution, but as the blood of normal horses yielded somewhat similar results, no importance could be attached to the reaction.

Vascular System.—Heart enlarged. In many cases showing numerous hemorrhagic patches underneath the endocardium or epicardium, and occasionally involving the whole thickness of the heart wall. The pericardium frequently contained an increased amount of fluid, and very occasionally showed sero-fibrinous pericarditis. Occasional hemorrhages in the costal pericardium. Heart muscle appeared dark in color, and in some instances where no macroscopic lesion was visible, red blood cells were to be seen between the seemingly normal muscle fibres. In some instances white, depressed areas, irregular in shape and size, were seen. These had probably been old hemorrhages or infarcts, and microscopically they showed replacement of the muscle by connective tissue. No changes in the vessels were noted which could be ascribed with certainty to this disease. In a number of instances firm coagula were found in the iliac vessels, evidently of some duration. These showed an alternation of red and white layers. In some instances these coagula were evidently related to abscess formation in the vicinity. In others, notably Case No. 8, both iliacs were obliterated by old coagula. The cœliac axis and the mesenteric vessels were frequently found plugged with coagula due to the presence of *strongylus armatus*.

The *spleen* in many instances did not seem to show marked change, although it was generally stippled with hemorrhages, showing through the capsule and sometimes markedly enlarged. Where peritonitis was marked, very often lymph flakes were seen covering its surface. The organ was found to be very rarely enlarged or soft, and well marked infarcts were not often seen. The consistency and general color were as a rule not markedly changed, except for the presence in most cases of the small hemorrhages already referred to. In one instance, as already stated, an abscess about two and one-half inches in diameter was found, involving the apex (Case 10). This was well walled off and separated from the remainder of the organ. This was the only instance in which an abscess was seen in this organ. The microscopic changes in the spleen cannot be reported here, since it is evident that much still remains to be done. The *bone marrow* has not yet been examined.

Lymphatic System.—The lymphatic glands are frequently swollen and infiltrated with a gelatinous exudate. In all cases it was possible to find certain lymph glands in which well marked hemorrhages could be demonstrated, and the whole gland was often found infiltrated with blood. The glands particularly affected were those in the axilla, groin, anterior mediastinum and certain mesenteric glands.

Respiratory System.—The pleura, both costal and parietal, frequently showed hemorrhages variable in number, size and shape.

Blood was never found free in the pleural cavity, although there was usually an excess of fluid. Sero fibrinous pleurisy was frequent but purulent pleurisy never seen, except where well marked superficial abscesses were present in the lungs. The lungs were frequently stippled in appearance or showed irregular somewhat depressed red areas ("swine plague lung"). These areas would seem to be due partially to hemorrhage and partially to collapse, and involved from one to several lobules, being visible. not only on the surface, but in sections of the lung. Pneumonia was not present as a rule except where lung abscesses were found. In one instance a long standing paralysis of the throat and the escape of food into the nose, produced a septic and gangrenous inflammation of the nasal passages. Emphysematous blebs and hemorrhages in the lungs were also present. (Case No. 11.) The spotted appearance of the lung indicated in some instances recent interstitial hemorrhage, and in others that the small amount of hemorrhage had set up lobular pneumonia and a partial collapse of the involved alveoli followed. Changes indicative of chronic irritation were not found. Bronchitis was never present in such manner as to suggest relationship to the disease.

Digestive Organs.—The stomach walls were frequently hemorrhagic, the hemorrhages being sub-peritoneal, sub-mucous, or in certain instances involving the whole thickness of the wall. This organ was usually found well filled with food, and with the exception of the hemorrhages and the results thereof, little, if any, change was observable. In the intestines there seemed to be no lesions demonstrable, except for the occurrence of hemorrhages similar to those noted in the stomach, and, in some instances, a marked inflammation of the peritoneal coat. Especial attention was not directed to the fauna of the intestinal tract, since this had been well studied by the Manitoba investigators.

The Liver.—This usually appeared increased in size and congested. In cases where peritonitis was marked, flakes of lymph covered its surface. The liver tissue was frequently softened, light in color and macroscopically and microscopically gave evidence of parenchymatous hepatitis. Branches of the portal vein were quite frequently found to contain whitish thrombi. Cirrhosis was present in at least two cases. Special study of the intestines and liver had been planned, but it was impossible to complete it for this report.

Genito-Urinary System.—The kidneys were usually markedly affected, showing evidence of parenchymatous nephritis. The capsules stripped readily, the cortex was thickened and light in color, and the pyramidal portions very often beefy red. The occurrence of hemorrhages under the capsule has already been referred to. Microscopic examination showed evidence of tubular degeneration and marked hemorrhage between and into the straight and collecting tubules.

The following is a short synopsis of the appearance of the medullary portion of the left kidney of Case No. 8. Congestion of capillaries, apparent increase in leucocytes in the blood vessels, many small areas of hemorrhage, both in the connective tissue and into the tubules, infiltration, consisting of round cells with a few polymorphonuclear leucocytes in and about the areas of hemorrhage. Extensive degenerative changes were not found in the epithelium of the collecting and Henle's loop tubules. The cortex of the same kidney showed a chronic inflammation with thickening of Bowman's capsule and adhesions between the glomerular loops and capsule.

The Bladder.—This frequently showed hemorrhages in its wall, sometimes involving the whole thickness and the areas some inches in diameter. The urine was frequently excreted in vast quantities and at short intervals. In the pelvis of the kidney and bladder a residue of the color and consistency of yellow paint was found on more than one occasion. Chemical and microscopic examination of such sediment and of the urine was made in a number of instances (Cases Nos. 8-14-15-19), but insufficient data has been gathered to be included here, although it may be stated that albumin was found absent or in minimal quantities, casts, red blood cells and pus were never demonstrated, and the sediment seemed to consist of calcium carbonate with some larger quantities of calcium oxalate.

Miscellaneous.—The skin, subcutaneous lesions, affections of synovial membranes, œdema, hemorrhages and abscesses into and between muscles and fasciæ have all been given above.

The central nervous system was not investigated to any great extent, and nothing can therefore be said concerning its lesions further than the occurrence of hemorrhage into and œdema of the membranes.

7. **Bacteriology.**—Material was secured for bacteriological examination from the sources already mentioned under "Methods of Study" and shown in tabular form in Tables II. and III.

At autopsy the cultures were made with a view of determining whether bacteria were present in the living fluids and tissues, and to ascertain if present, the localities to which they had been distributed and the channels through which the distribution had taken place. Pains were taken to guard against the bactericidal properties of the blood and tissues, and to employ enough material in the sowings to be reasonably certain that in the event of failure of development bacteria had been absent at the location from which the sowing had been made. In the living cases the sources from which cultures could be made were limited in number and consisted of blood, œdematous and synovial fluid, and in certain cases urine. In the first cases investigated at autopsy, micro-organisms were found, which seemed to belong to the hemorrhagic septicæmia group, i. e., of the same class as *B. bovisepticus* of hemorrhagic septicæmia in cattle and wild animals, such as buffalo, etc., *B. suisepticus* or swine plague bacillus, *B. choleræ gallinarum* of chicken cholera and the group of "ovoid bacilli," causing those diseases grouped under "Pasteurellose," by Trevison. This bacillus was uniformly found during the investigation of cases of "swamp fever" by this board, and is fully described below as *B. equisepticus.*

During the summer of 1902, on two farms (Outbreaks II. and VI.), from a number of horses killed for autopsy (Cases Nos. 9-10-11-14-15), and one horse examined whilst alive (Case No. 12), a bacillus with constant characteristics, which is later described as *B. pyrogenous equinus* was encountered. In a number of these animals its great abundance almost overshadowed the presence of *B. equisepticus,* and at that time caused considerable uncertainty as to the ætiology of the disease. Very careful examination of all cases investigated later served to exclude positively this micro-organism, as it was not encountered at all in those cases investigated subsequent to Sept. 7, 1902. Its relationsip, if any, to the disease, cannot be stated at this time. A positive demonstration of *B. equisepticus* in 17, and its probable presence in two other cases, 19 in all, would seem to show its ætiological importance in this disease, more especially in consideration of the experimental work, later given in this report. In only two cases (Nos. 26 and 28) in which autopsy has been made was it found impossible to demonstrate the presence of this micro-organism in the fluids or tissues. In Cases Nos. 7 and 8, micro-organisms morphologically resembling *B. equisepticus* were present in two or more localities, but through accident it was impossible to submit them to the final proof in order to establish their identity beyond question. In Case No. 26, owing to the difficulties under which the autopsy was held and the admixture of so many contaminating micro-organisms, it is possible that *B. equisepticus* might have been present, although it was not isolated in purity. In Case No. 28 (Manitoba) micro-organisms were only obtained from three sources. The remaining eight sources from which cultures were made seemed to be sterile, as no micro-organisms developed. This case was one which the Manitoba authorities regarded as convalescent although not completely recovered.

It is thus evident that *B. equisepticus* was obtained practically from every case in which this disease was active, and in which a satisfactory autopsy was permitted. There is no evidence to show that it was absent from the tissues in Case No. 12, although not demonstrated. *B. equisepticus* was only found in the blood cultures made from two animals during life (see Table III.), and in the fluid from an enlarged gland at the angle of the jaw. (Cases Nos. 14 and 15). It would appear, therefore, that there may be times during which the micro-organism is not present in any considerable numbers in the circulating blood.

B. equisepticus would seem to be beyond doubt the same micro-organism as that obtained by Lignières from cases which he describes under the name of "typhoid fever in the horse." A few minor differences will be noted in the description of the micro-organism and its cultural peculiarities. Lignières' description of the disease studied by him differs very materially from "swamp fever" in symptoms, course and autopsy findings, although it has many points of resemblance. The following is a description of *B. equisepticus:*

Bacillus Equisepticus.—*Morphology,* as obtained from horses suffering from swamp fever is a small, non-motile, ovoidal bacillus. In direct coverslip preparations of the blood or tissues of animals it is from 0.6 to 0.8 microns in transverse diameter, and from 1.0 to 1.5 microns long. The size of this organism varies greatly. In blood or tissue preparations the bacilli are usually larger than those grown in or upon artificial media. There is considerable variation in size, even in the same culture. In hanging drop preparations the bacilli sometimes resemble pairs of minute diplococci being analogous to the belted appearance seen in stained specimens. Occasionally several bacilli are noticed in chains, the individuals being so small as to resemble minute streptococci. In these investigations chains consisting of more than three bacilli i. e., resembling a row of six cocci, have never been seen. In n

TABLE III. SHOWING RESULT OF CULTURES MADE DURING LIFE OF HORSES IN WHICH A DIAGNOSIS OF "SWAMP-FEVER" SEEMED CORRECT.

Horse No.	Owner.	Locality.	Date of Examination	Cultures from Blood Stream.	Cultures from Other Sources.	Fate of Animal.	Bacterial Findings at Autopsy.
10	W. S.	Beltrami	July 24, '02	B. subtilis (?). Skin (?)		Killed, autopsy Aug. 19, '02	B. pyrogenes eq. B. equisepticus. Other bacteria.
12	H. P.	Beltrami	Aug. 1, '02	B. pyrogenes eq. Other bacteria	Oedema chest—B. pyrogenes eq. and other bacteria	Died Aug. 8, '02. No autopsy	
13	J. B. H.	Sauk Rapids	July 31, '02	Diplococci Other bacteria		Killed 8 hours before autopsy, Sept. 12, '02	B. equisepticus. Dipl. pneumoniae. Other bacteria.
14	H. P.	Beltrami	Aug. 19, '02.	Unident. bac.	Urine—sterile	Killed for autopsy, Aug. 26, '02	B. pyrogenes eq. B. equisepticus. Other bacteria.
15	H. P.	Beltrami	Aug. 19, '02 Aug. 26, '02	B. equisepticus.	Enlarged gland at jaw B. pyro. eq., B. equisepticus, dipl. pneumoniae Hock—no growth	Killed for autopsy, Sept. 7, '02	B. pyrogenes eq. B. equisepticus. Other bacteria.
20	P. M.	Beltrami	Aug. 26, '02.	Sterile		Died Jan. 12, '03, autopsy Jan. 14, '03	B. equisepticus. Other bacteria.
21	P. N.	Beltrami	Aug. 26, '02.	Staphylococcus			
22	P. M.	Beltrami	Aug. 26, '02.	Sterile.			
23	L. F	Beltrami	Sept. 8, '02	Contaminated			
25	J. B. H.	Sauk Rapids	Sept. 12, '02.	Sterile	Oedema over sternum—staphylococci	Died Oct. 2, '02. No autopsy	
29	C. C.	Winnipeg	Oct. 20, '02	Sterile			
30	A. A.	Russia	Oct. 23, '02		Abscess chest—unident. bac., oedema belly—sterile		
37	T. H.	Hallock	Feb. 7, '03 Feb. 11, '03	B. equisepticus.		Died Feb. 11, '03	B. equisepticus. Other bacteria. Streptococcus.

instance have such long chains as those figured by Wertheim* for chicken cholera been encountered.

The bacilli have a marked Brownion movement, but are never motile.

Staining.—This organism does not stain by Gram's method. In specimens prepared directly from the blood or tissues of animals or in 24-hour broth cultures stained by Löffler's alkaline methylene blue, nearly all the bacilli show the ends intensely stained, and the central portion very faintly or entirely unstained. The variation in the length already mentioned, seems to depend upon the length of this unstained middle portion rather than upon the size of the solidly staining ends, as pointed out by Theobald Smith† for swine plague bacilli.

In preparations grown on the surface of solid media for 24 hours and stained with Löffler's alkaline methylene blue, the bacilli are nearly always evenly stained throughout. Only rarely can the belted appearance be noticed. In preparations from solid media older than 24 hours the bacilli do not stain well, but appear as a mass of *debris*, and it is with difficulty that the individual organisms can be distinguished.

Cultures made directly from the tissues or blood upon meat extract, agar and serum, do not grow well and may show no growth, while cultures from the same source made into broth show a fairly abundant growth after 48 hours. After one or two generations in broth, the organism grows much better on solid media. In this manner the organism may be overlooked, even when quite abundant, unless second sowings are made upon solid media from the broth after it has been incubated 24 to 48 hours. During the latter part of these investigations the agar used has been made according to Ravenel's method.§ Agar made in this manner afforded a more abundant growth than any solid media that has been used, which is contrary to the experience of Lignières with his "*bacille ovoide.*"

Cultural Characteristics.—Broth cultures become uniformly but faintly clouded in 24 hours at incubator temperature, more slowly at room temperature. After several days there is usually a faint gray ring on the glass at the surface of the broth. In old broth cultures there is sometimes a flocculent precipitate at the bottom of the tube and at others a gray viscid deposit.

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*Archives für Path. und Pharmakol. Bd. XXVI., 1889, p. 61.

†U. S. Bureau Animal Industry, 1891, Special Report on the Cause and Prevention of Swine Plague, p. 85.

§Transactions of American Public Health Association, Vol. XXV., p. 605.

In Dunham's peptone solution there appears a very faint diffuse cloudiness in 24 hours. In cultures older than 24 hours a slight flocculent precipitate appears at the bottom of the tube. No indol is formed. The growth on blood serum (Löffler's + 1.25 per cent glycerine) is very fine, fairly abundant with slightly raised even edges, and of the same creamy color as the serum. The serum is not digested. After 24 hours the growth upon plain and glycerine agar slants is abundant, moist and transparent. In cultures older than 24 hours the growth becomes creamy white, drier and viscid, adhering firmly to the surface of the agar.

No visible growth develops upon potato. In gelatine stab cultures a very faint gray growth occurs at the surface and along the track of the needle without liquefaction. Litmus milk is unchanged. Strains of the organism from many sources, sown into litmus milk, have been under observation for several weeks at a time, and in no instance was any change noticed. The growth upon saccharose and maltose litmus agars is moist and transparent. It is more abundant than that occurring upon dextrose and lactose litmus agars. Upon the latter two the growth is very fine, granular and transparent. In cultures older than 24 hours upon the litmus sugar agar media the growth becomes creamy white and viscid as noted for plain agar. There is no change in or upon any of the litmus sugar agar media at any time. The organism does not form gas.

Pathogenesis. (For detailed account, see "Experimental Investigations," page 350.) Twelve of the seventeen strains of this micro-organism were found to be equally virulent, so far as tested. Doses of 0.00000001 c. c. to 1.0 c. c. of a fresh broth culture killed rabbits in less than 16 hours after intravenous inoculation. A series of tests (Table IV., Experimental Investigations) showed that in most instances death took place in from two and one-half to seven hours after such inoculations. There was no evidence to show that the site selected for inoculation influenced resistance to infection as the results of intravenous, intra-peritoneal and subcutaneous injection, were almost identical.

Guinea pigs, pigeons and English sparrows were all found to be susceptible. White mice, dogs and swine resisted inoculation.

Horses were extremely susceptible, although it has thus far been impossible to reproduce the chronic form of the disease in all its manifestations, which is probably due to mode of inoculation or extreme virulence of the organism.

Bacillus Pyrogenes Equinus—A bacillus whose cultural and other characteristics permitted of its easy identification was obtained from five cases of swamp fever at autopsy (Nos. 9-10-11-14-15), and from one case examined while alive (No. 12).

As will be seen from the description of this micro-organism, it is capable of producing hemorrhages and other lesions in the horse, as well as fatal results in these and other animals. The part that it plays, if any, in swamp fever is as yet unknown. So far as has been ascertained this micro-organism has not been described in connection with other diseases of horses, nor has it been found by this laboratory in the tissues of normal horses or horses suffering from any other disease nor in fact in any other site than the tissues of these six cases of "swamp fever."

The following is a description of *B. pyrogenes equinus*, so named on account of its power of producing very marked pyrexia when inoculated into these animals.

Morphology is a motile, rod shaped bacillus with blunt ends. It is indistinguishable in size and morphology from *B. coli communis.* In broth cultures, chains of two and rarely three, bacilli can be seen. The organism is actively motile. It does not form spores.

Staining.—It stains deeply and evenly with Löffler's alkaline methylene blue. It does not retain the stain by Gram's method.

Cultural Characteristics.—Twenty-four-hour broth cultures are uniformly cloudy, have a slight flocculent precipitate at the bottom of the tube and a white granular ring on the glass at the surface of the broth. Old broth cultures have a fairly heavy, gray, wrinkled pellicle over the surface and a heavy white precipitate at the bottom of the tube. When shaken up the pellicle breaks into small scales and falls to the bottom.

The growth in Dunham's peptone solution is very slight. After 48 hours there is uniform cloudiness and a thin gray film over the surface of the medium. A trace of indol is formed.

On blood serum (Löffler's + 1.25 per cent glycerine) the individual colonies after 24 hours are small, moist, gray and rounded. In older cultures the colonies increase in size, become flattened, dryer, and have one or two concentric ridges. When the sowing is heavy the growth in 24 hours is fairly abundant, granular, and is roughened near the edges. Upon close examination this roughness along the edges is seen to consist of very small wrinkles. As the cultures get older, the wrinkling becomes general over the whole growth. The growth appears dry, and does not seem to increase in thickness except where the wrinkles occur.

The growth on the surface of plain agar is very characteristic, and serves to distinguish the organism from *B. coli communis*, as well as all other bacteria met with in this laboratory. After 24 hours small individual colonies are moist, rounded and transparent. As the colonies get older they increase in size, become gray, dry, appear to flatten out, and have one or two concentric ridges. They are thicker in the center than at the edges, which causes them to look terraced.

In moderately heavy sowings made with a loop on the surface of agar, the growth looks like a thin, gray, finely corrugated membrane stretched over the surface of the agar, with occasionally a heavy wrinkle. The corrugations are small wrinkles, and as the culture gets older the growth, which takes place principally in a plane parallel with the surface of the medium, does not appear to increase in thickness, but the wrinkles become larger and extend in all directions, as if some resistance had been met with at the edges which caused the membrane to wrinkle in the center. The original development of wrinkles is seen best where individual colonies are few in number; then, as the colonies increase in size and become confluent, the wrinkles occur at the points of contact. When the growth is very abundant wrinkling does not occur.

On potato the growth is moderately heavy and wrinkled. It has a peculiar silver white metallic luster. A heavy wrinkled pellicle forms over the water in the bottom of the tube.

In gelatine stab cultures a faint gray growth occurs at the surface, and along the track of the needle after 48 hours without liquefaction.

Litmus milk becomes faintly acid in 24 hours. Later it becomes alkaline, a gray sediment forms at the bottom of the tube and a thin scaley pellicle forms over the surface. The milk is not coagulated.

The growth upon the sugar agar media is rapid and abundant, and has the same general appearance as that upon plain agar.

Litmus dextrose and litmus maltose agars are reddened throughout in 24 hours, accompanied by gas formation.

Litmus lactose and litmus saccharose agars are unchanged after 24 hours; in older cultures the medium becomes a deep blue. No gas formation takes place in these latter two.

In dextrose broth the formation of gas is rapid and abundant. The gas reaction varies from $\frac{H}{CO_2} = \frac{3}{1}$ to $\frac{H}{CO_2} = \frac{7}{1}$

Pathogenesis. (For detailed account, see "Experimental Investigations," page 361.) The pathogenesis of *B. pyrogenes equinus* has not been studied as thoroughly as that of *B. equisepticus,* since it was only found in six of the cases, and in but two of the outbreaks of swamp fever investigated. In small doses of fresh broth cultures rabbits were killed in from one to eight days. Hemorrhages on the serous surfaces were found at autopsy, and the bacillus recovered from the tissues and blood stream. Horses were susceptible to intravenous injection, large doses producing death in three or four hours, small repeated doses producing extreme elevation of temperature.

The relationship of this organism to swamp fever, if it has a relationship, cannot be stated at this time. The fact that it has not been met with in this laboratory, except in cases of swamp fever, that it produces hemorrhages on serous surfaces in both rabbits and horses, and a peculiar yellowish or gelatinous œdema, such as that found in certain of the swamp fever cases at autopsy, would naturally direct atention to it as a possible or probable ætiological factor in the disease, were it not for the finding of *B. equisepticus* in practically all cases of swamp fever which came to autopsy.

8. **Diagnosis.**—Weakness is usually the first symptom noticed. The animal is "out of sorts," sweats easily, and is not able to do its accustomed amount of work. Gradual emaciation and anæmia, as evidenced by the pale and often jaundiced mucous membranes—occasional petechial hemorrhages—when accompanied by unimpaired or voracious appetite, and the characteristic staggering gait constitute a train of symptoms which cannot be easily mistaken.

The voiding of large quantities of urine at frequent intervals is often to be observed, and at late stages of the disease patches of œdema often appear upon the chest, belly and legs.

The presence of these symptoms and the demonstration of *B. equisepticus,* at autopsy, afford a basis for absolute diagnosis. The experience derived from these investigations seems to show that *B. equisepticus,* can rarely be obtained from the blood during life.

In those cases in which œdematous patches, abscesses or synosial effusion occur, it is frequently possible to show the presence of *B. equisepticus* in fluids obtained from these sources provided sufficient quantities of fluid are used for sowing large quantities of broth.

9. **Prognosis.**—The prognosis of the disease is very unfavorable. The mortality in the cases studied by this board is over 80 per cent.

Many believe that recovery never takes place, and when recovery is reported they doubt the diagnosis. Some well marked cases, however, do apparently recover, but the animals rarely regain their accustomed vigor.

10. **Treatment.**—Medication seems to be of doubtful value, although in general tonics and stimulants are indicated. Iron, arsenic, quinine, strychnine and various compounds have been employed, with varying results.

Early in these investigations the futility of the ordinary method of medication became apparent, and plans were made and steps taken for the elaboration of prophylactic and curative measures. The methods employed and the results obtained are reported under "Experimental Investigations," page 369. It is unfortunate that this line of investigation had to be abandoned, since it is one that promised well, but required considerable time for its completion, even with the facilities which this board had been able to provide, just prior to the transference of the study of infectious diseases of animals to other hands.

11. **Prophylaxis.**—Although the presence of *B. equisepticus* was only demonstrated once in the urine, it is only fair to state that examinations were not frequently made. The marked kidney lesions would seem to warrant a belief that urine may be a frequent vehicle for the spread of the disease.

The presence of hemorrhagic areas in the intestinal wall, and the fact that the "atrium" is probably alimentary, would warrant the assumption that manure may often be the means of transmission. The history of the occurrence of this disease in this state, as well as the above, would serve to show the desirability of excluding swamp or native hay, over which sick animals may have been running, from the diet list. Segregation of sick animals, and their proper disposal when dead, with disinfection of the stalls occupied by them appear to be indicated, notwithstanding the paucity of data tending to show the infectiousness of this disease.

EXPERIMENTAL INVESTIGATIONS.

From the animals and sites mentioned under the details of the individual outbreaks and cases of swamp fever, strains of *B. equisepticus* and *B. pyrogenes equinus* were isolated, studied in pure culture and the effects of their inoculation into various animals noted. In the case of *B. equisepticus* which was obtained from practically all cases of the disease, these studies were much more extensive, and its pathogenesis for the various laboratory animals as well as the horse, was determined with some minuteness. Not only was its capacity for producing death in the laboratory animals studied, but attempts were made to reproduce the disease by intravenous inoculation. Whilst it was recognized that this method of infection probably differed materially from that which occurred naturally, and plans were made for feeding and inhalation experiments, it was deemed best to begin by the method likely to produce with most certainty the infection of the animal.

The necessity for concluding the experiments and making a report at this time, renders further apology or explanation for the incompleteness of results unnecessary.

Pathogenesis of Bacillus Equisepticus.—*B. equisepticus*, as obtained from the different clinical cases of swamp fever in this investigation, would seem to be not only of extreme, but of constant virulence. Of the seventeen strains of the organism obtained at autopsy, or from fluids or tissues of horses suffering from this disease, twelve have been tested by inoculation into animals and were found highly virulent for rabbits in comparatively small doses. Reference to the details of laboratory findings given for each case investigated, will show that small doses of fresh broth cultures invariably killed rabbits within a few hours after inoculation (i. e., animals inoculated one day were found dead on the following morning, almost without exception).

As a rule, when pathogenesis was thus demonstrated, no further inoculations were made, since one particular strain, viz., that obtained from Case 34, was studied very thoroughly, and the virulence accurately measured. Whether the same virulence could have been demonstrated for all strains, cannot be definitely stated.

Most of the inoculations were given intravenously, but in general, from the observations made in the laboratory, it would appear that the onset of symptoms was not more rapid, nor the virulence exhibited greater after intravenous, than after subcutaneous and intraperitoneal administration. The initial high grade of virulence of the cultures obtained from the tissues of horses sick with the disease did not seem to be increased by passage through rabbits, horses, or other animals. Rabbits inoculated in the afternoon were found dead the following morning with such regularity that it was determined to find out the time taken to produce death, and the minimal lethal dose. The strain isolated from Case 34, was chosen for the experiments, since it was the most recently isolated strain at the time. The results in detail are shown by the following table:

TABLE IV.—SHOWING VIRULENCE AND MINIMUM LETHAL DOSE OF BACILLUS EQUISEPTICUS.*

Rabbit Number.	Weight in Grams.	ORIGIN OF CULTURE.	Age of Broth Culture—hrs.	No. of Times passed thro. Animals.	How Inoculated.	Amount of Inoculation in c. c.	Time Elapsed until Death.	B. Equisepticus Recovered Unmixed.	Autopsy Findings.
634	810	Liver of horse, swamp fever. Case 34	22	......	Intravenous..	1.0	3 hrs. 50 mins.	No autopsy..	....
632	1810	Liver of horse, swamp fever. Case 34	48	......	Intravenous..	1.0	2 hrs. 30 mins.	Yes..........	No gross lesions.
711	1970	Liver of rabbit. 708....................	24	7	Intravenous..	1.0	4 hrs. 50 mins.	Yes..........	Froth flowed from nostrils. Lungs hemorrhagic (swine plague). Large amount bloody serum in pleural cavity. Pericardial fluid increased. Small abscess in middle lobe of liver near margin.
755	2060	Heart's blood of rabbit. 751..........	24	9	Intravenous..	0.4	7 hours.......	No autopsy..	....
605	2050	Abscess, biceps, horse, swamp fever. Case 19....................	60	......	Intravenous..	1.5	6 hours.......	Yes..........	Hemorrhages into uterus and tubes. Lungs congested. No other gross lesions.
702	702	Lung of exp. horse 6, swamp fever. Case 11....................	24	2	Intravenous..	1.0	5 hrs. 15 mins.	Yes..........	Lungs congested. Pleural cavity contained large amount of bloody serum.
635	710	Liver of horse, swamp fever. Case 34....................................	48	......	Subcutaneous	0.5	16 hrs. or less†	Yes..........	Slight straw colored exudate at site of inoculation. Many minute hemorrhages in thymus gland and heart muscle. Bloody exudate in pleural cavity.
659	....	Heart's blood of rabbit. 640.........	24	2	Intravenous..	.000,001	16 hrs. or less†	Yes..........	Right lung hemorrhagic. Large amount of clear serum in pleural cavity.
638	2070	Rabbit. 633..........................	24	1	Intravenous..	.000,001	16 hrs. or less†	Yes..........	Lungs "swine plague." Pleural and pericardial cavities contained an increased amount of clear serum.
646	2100	Rabbit. 633..........................	24	1	Intravenous..	.000,001	Not killed....	....	....
639	1860	Rabbit. 633..........................	24	1	Intravenous..	.000,000,1	16 hrs. or less	Yes..........	Same as No. 638.
640	1820	Rabbit. 633..........................	24	1	Intravenous..	.000,000,1	16 hrs. or less	Yes..........	Lungs "swine plague." Minute hemorrhages into heart muscle. Large amount of clear serum in pleural and pericardial cavities.
643	1600	Heart's blood of rabbit. 640..........	24	2	Intravenous..	.000,000,1	40 hrs. or less	Broth found to be acid. No growth..	Right lung congested, "swine plague." Pleural and pericardial cavities contained large amount of clear serum.
641	1070	Heart's blood of rabbit. 640..........	24	2	Intravenous..	.000,000,01	16hrs. or less	Broth found to be acid. No growth..	Lungs hemorrhagic. No other gross lesions.
642	2050	Heart's blood of rabbit. 640..........	24	2	Intravenous..	.000,000,01	16 hrs. or less	Broth found to be acid. No growth..	Same as No. 641.
644	1680	Heart's blood of rabbit. 640..........	24	2	Intravenous..	.000,000,1	Not killed....	....	....

* These cultures were all obtained from "Swamp Fever" case 34.

† 16 hours or less in this column means that the rabbits were inoculated between 3 and 6 p. m. and found dead the following morning between 7 and 8 a. m.

A study of the foregoing table serves to show:

1. The extreme virulence of the organism which in doses of 0.4 to 1 c. c. killed rabbits in from two and a half to seven hours. This is the most virulent organism encountered in the experience of this laboratory.

2. The disease produced in the rabbits is a true *septicæmia*, although at first the rapid course of the disease was attributed to toxin production. The minuteness of the dose (.000,000,01 to .000,001 c. c.) required to produce death in from sixteen to forty hours or less, would stamp the process as a septicæmia. By plating out the same quantities from the same syringe used for these smallest doses it was computed by the number of colonies which developed that from one to eight bacilli sufficed to produce a septicæmia with death, in less than sixteen hours. The demonstration of living micro-organisms in the tissues, blood and organs of animals which succumbed to intraperitoneal and subcutaneous injections, as well as those intravenously inoculated, is further proof of their septicæmic nature, whilst observations on clinical cases and horses experimentally inoculated, corroborate the point.

3. No very marked gross lesions followed the inoculation of *bacillus equisepticus* into rabbits, with the exception of hemorrhages noted in the various glands and organs, and on the different serous surfaces, and an increase of fluid in the cavities.

Guinea Pigs.—Guinea pigs were found susceptible to this organism, but were slightly more resistant than rabbits. The lesions found at autopsy were practically the same as those found in rabbits.

It was found unnecessary to employ guinea pigs for isolating *B. equisepticus*, in pure culture, although intraperitoneal inoculation of these animals, was the method used by Lignières in his observations.

Pigeons.—Pigeons were found extremely susceptible to this organism. As small a dose as .000,001 of c. c. of a 24-hour broth culture inoculated into the breast muscle, produced death in less than 24 hours.

English Sparrows.—The English sparrow is susceptible to this organism when inoculated into the breast muscle with small doses.

White Mice.—No extensive observations were made in the employment of this animal for inoculation experiments, but it would appear that it is not as susceptible as guinea pigs, rabbits, and pigeons.

Dogs.—Dogs were resistant to intravenous inoculations of this organism. Subcutaneous inoculation caused extensive œdema, at the site of inoculation, followed by ulceration of the skin and granulation of the wound. Loss of appetite and depression are apparent for several hours after inoculation.

Swine.—Swine do not appear to be susceptible to this organism when given intravenously or subcutaneously. As much as 30 c. c. of a 24-hour broth culture, has been given intravenously without producing any noticeable results.

Horses.—The following detailed statement of inoculation experiments into horses show the effect produced by large individual and repeated small doses of *B. equisepticus*, injected into the blood stream.

Experiment Horse No. 4.—Bay mare, weight about 900 pounds. This horse had been at work for several months previous to this time, and was apparently strong and healthy. She was in fair condition.

Dec. 22, 1902, blood examination was as follows:

Hæmoglobin (Tallquist), 80 to 100 per cent; red cells, 10,640,000; leucocytes, 8,000.

Dec. 23, 1902, at 10:30 a. m., this animal was inoculated into the jugular vein with 10 c. c. of a 24-hour broth culture of *B. equisepticus*, from "swamp fever" Case No. 34. The culture used was obtained from Rabbit No. 633 (first passage through animals). This inoculation produced, within an hour, diarrhœa, a very marked temporary polyuria, rapid labored respiration, and later rigors followed by profuse sweating. The temperature gradually increased to 103.6° F. at 11:30 p. m. The next day the temperature had receded to 102° F. December 26th, the temperature had reached 101° F. and the animal appeared entirely well. At 11:30 a. m. on this date, a second inoculation of 12 c. c. of a 24-hour broth culture of *B. equisepticus*, from Case No. 34, the culture inoculated being from Rabbit No. 640 (second passage through animals), was given into the jugular vein. A portion of the inoculation material escaped into the subcutaneous tissues of the neck, causing a tumor about one and one-half inches in diameter. This became extremely sensitive on the second day and later developed into an abscess which was incised Dec. 30, 1902 (4 days after the inoculation), and about one ounce of yellow blood-streaked pus evacuated. Cultures from this pus gave *B. equisepticus* in pure culture. This abscess discharged pus for a few days and then healed. On this same day, cultures were taken from the blood for bacteriological examination. After being incubated for 48 hours, no growth appeared. This inoculation produced diarrhoea, marked temporary polyuria, and labored respiration. One and one-half hours after inoculation there was a severe chill followed by profuse sweating. Two hours after inoculation the temperature was 106.8° F., respiration 52 and pulse 62. In two days the animal had apparently recovered.

Dec. 29, 1902, blood examination was as follows:

Hæmoglobin (Tallquist), 80 to 100 per cent; red cells, 8,104,000; leucocytes, 18,000.

At 10:30 a. m. the same date, and three days after the previous inoculation, a third intravenous inoculation was made of 30 c. c. of a 24-hour broth culture of *B. equisepticus* (Case No. 34) from Rabbit No. 640 (2d passage through animals) and 10 c. c. of a 48-hour broth culture of *B. equisepticus* (Case No. 34) from Rabbit No. 633 (1st passage through animals). This inoculation produced the same symptoms as the previous ones, namely, diarrhoea polyuria, labored respiration, rigors and profuse sweating, but all the symptoms were more severe. Two hours after the inoculation the animal was lying down and could not be compelled to get up again during the day. The temperature on this occasion did not rise as high as previously, 104.2° F. being the highest, five hours after inoculation.

Dec. 31, 1902, a swelling appeared in the left hock joint. This was quite sensitive and gave fluctuation. The animal held the left foot from the floor and stepped upon it only when compelled to do so. This swelling continued and finally the whole leg became swollen and sensitive, and was practically useless to the animal from this time on.

Jan. 7, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 70 per cent; red cells, 8,932,000; leucocytes, 17,000.

On this date the skin over a portion of the left hock joint was seared with a hot iron and a glass pipette introduced into the joint cavity. A small amount of clear, straw-colored serum was drawn off, for the purpose of making cultures. These cultures gave *B. equisepticus* unmixed with other organisms.

Jan. 1, 1903, the animal was down and unable to get up. From this time on, emaciation was rapid and accompanied with gradually increasing weakness. The appetite, however, remained good. From time to time the animal was raised in the sling, for the purpose of rest, and to prevent injury in its efforts to get up.

Jan. 17, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 70 to 80 per cent; red cells, 7,336,000; leucocytes, 12,000.

Jan. 26, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 70 per cent; red cells, 8,742,000; leucocytes, 39,000.

By this time the animal had become so weak that it was thought best not to keep her longer. In order to determine whether or not any immunity had been established, it was decided to inoculate with a large dose of *B. equisepticus*. Consequently she was inoculated intravenously at 10:45 a. m. with 210 c. c. of a 24-hour broth culture of *B. equisepticus* from the spleen of Experiment Horse No. 5 (originally from Case No. 34). This inoculation produced severe symptoms of prostration within an hour, and the horse died at 2:45 p. m. from collapse.

Autopsy, five p. m., Jan. 26, 1903. Autopsy notes taken at this time, were as follows:

Autopsy was held by lamplight, and therefore it was very difficult to see the lesions. Low down in the neck on left side, there was a small tumor running parallel with the jugular vein. Upon opening this the surrounding tissues were thickened and yellowish. The tumor contained a clear straw-colored fluid. Beneath the skin over the ribs were several hemorrhages. These did not appear to be recent. The heart was very large and contained a large chicken fat clot in the left auricle. Over both the external and internal surfaces of the heart muscle were numerous hemorrhages, varying in size from a pin point to the size of a pea. These were very dark colored and were especially marked along the area, between the ventricles. The lungs contained many petechial hemorrhages, and some larger ones. The liver and kidneys were apparently normal. The spleen was mottled over its entire surface with small hemorrhages. Several of the mesenteric glands of the small intestine were enlarged and hemorrhagic. The left hock was opened. All the surrounding tissues were much thickened and hemorrhagic. The joint itself contained a small amount of sero-sanguineous fluid.

Cultures were taken from the lung, heart's blood, kidney, liver and spleen. Cultures from the spleen showed *B. equisepticus* in pure culture. Cultures from the liver showed *B. coli communis* in pure culture. No growth appeared in or on the cultures taken from the lung, kidney and heart's blood.

Experiment Horse No. 12—Brown horse, weight about 1,100 pounds. This horse was old, thin and had been foundered. It was very lame in both front legs. He had been fed from Jan. 30 to March 13, 1903, on ensilage (see page 156, this report). Since no evil results were obtained from the previous experiment, it was thought advisable to use him again.

March 25, 1903, the blood examination was as follows:

Hæmoglobin (Tallquist), 100 per cent; red cells, 7,904,000; leucocytes, 11,000.

At 4 p. m. on this date, the animal was inoculated intravenously into the jugular vein, with 10 c. c. of a 24-hour broth culture of *B. equisepticus* from Rabbit No. 718 (eighth passage through animals, from Case No. 34). At 5 p.m. the respirations were labored, the horse was trembling and refused food. At 7:25 p. m. the temperature had reached 105.2° F. The horse was sweating, but otherwise appeared improved. The next morning the temperature was 101.8° F. There was diarrhoea and polyuria. The urine looked very red, but was not examined, and the horse's hind legs appeared to be weak.

On March 27, 1903, two days after inoculation, the horse did not eat well, there was a slight effusion in the left hock and considerable lameness in this leg. The horse appeared to be very weak and scarcely able to stand. During the night the horse lay down and had to be raised in the sling the next morning. From this time on the horse was never able to get up alone, and was raised in the sling at various times, for the purpose of rest and to prevent injury in his efforts to get up. The left hind leg became very much swollen and extremely sensitive.

March 31, 1903, the blood examination was as follows:

Hæmoglobin (Tallquist), 100 per cent; red cells, 8,412,000; leucocytes, 26,000.

On April 3, 1903, the animal appeared stronger, ate well, and was able to stand when the sling was removed. From this time on there was gradually increasing weakness and emaciation. The appetite was only fair. During the night of April 9, 1903, the animal died.

Autopsy was held at 9 a. m. the morning of April 10. Autopsy notes are as follows:

The left shoulder contained a large superficial abscess, discharging pus, which was probably caused from injury. The left hind leg contained a large abscess on its inner aspect, along the popliteal artery, which contained fluid pus. This hind leg had been swollen and very sensitive for more than a week. The hock joint contained a considerable amount of clear straw-colored fluid. The tissues about the hock joint were very much thickened. The left lung was almost solid, and very dark red. This was probably due in a large part to hypostatic congestion. The horse had lain on its left side at different intervals for several days. The left side of the pericardium was covered with large, dark hemorrhages. The right lung was slightly congested in the anterior lobe, but otherwise appeared normal. The left heart contained a large "chicken-fat" clot. The endocardium was covered with hemorrhages. The heart weighed 11 pounds. The liver weighed 18 pounds. Its surface was covered with stringy masses of fibrin. Otherwise it appeared normal. The spleen weighed three and one-half pounds, and appeared to be normal. The kidneys appeared to be normal. The large mesenteric artery was slightly thickened and contained *strongyli armati*, but no clots.

Experiment Horse No. 7.—Black pony, white face and feet; weight about 850 pounds. This pony was in good flesh, and apparently in good health, except that it had the "heaves."

Jan. 12, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 70 to 80 per cent; red cells, 6,120,000; leucocytes, 18,000.

At 12:30 p. m. on this date the animal was inoculated intravenously into the jugular vein with 10 c. c. of a 24-hour broth culture of *B. equisepticus*, obtained from the spleen of Experiment Horse No. 5 (originally isolated from "swamp fever" Case No. 34). In one half an hour this produced a rapid, labored respiration, with a gradual rise of temperature, reaching 103.8° F. at 3:30 p. m. The next day the horse was apparently fully recovered.

Jan. 19, 1903, the blood examination was as follows:

Hæmoglobin (Tallquist), 80 to 90 per cent; red cells, 7,428,000; leucocytes, 20,000.

Jan 30, 1903, at 10:45 a. m., the animal was inoculated intravenously into the jugular vein with 10 c. c. of a 24-hour broth culture of *B. equisepticus*, obtained from the spleen of Experiment Horse No. 4 (strain from Case No. 34). This produced the same symptoms as the previous inoculation. The temperature reached 102.6° F. at its highest, at 4 p. m. As in the previous inoculation, the horse appeared entirely well the following day.

Feb. 3, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 80 to 90 per cent; red cells, 9,920,000; leucocytes, 7,000.

At 10:15 a. m. on this date the animal was again inoculated intravenously into the jugular vein with 20 c. c. of a 24-hour broth culture of *B. equisepticus*, obtained from the spleen of Experiment Horse No. 4. The same symptoms were again noted, as in the previous inoculations. The temperature reached 105.5° F. at its highest, at 3 p. m. The animal had apparently entirely recovered the following day.

Feb 17, 1903, the blood examination was as follows:

Hæmoglobin (Tallquist), 90 per cent; red cells, 10,608,000; leucocytes, 11,000.

At 11:15 a. m. on this date, the animal was inoculated intravenously into the jugular vein with 40 c. c. of a 24-hour broth culture of *B. equisepticus*, obtained from the spleen of Experiment Horse No. 4. Within 15 minutes the respiration became rapid and labored, diarrhoea appeared, there was much escape of fluid from the mouth and profuse sweating. At 12 m. the temperature was 100.2° F. and the animal appeared to be slightly better. At 2 p. m. the animal seemed to be in about the same condition, and was still standing. At 2:30 p. m. the horse was found dead.

At 4:30 p. m. an autopsy was made. Autopsy notes are as follows:

The subcutaneous tissues were fairly normal. The lungs showed a number of small dark hemorrhages. The anterior lobes were markedly emphysematous with patches of consolidation. The remaining anterior half of the lungs was congested; in fact, the lungs were more or less congested, and did not collapse as they should when the chest was opened.

The pericardium contained little fluid. The heart showed many small petechial hemorrhages on its external surface, but none on the internal. All the cavities of the heart were distended with very black clotted blood, which did not tend to change rapidly on exposure to air. The intestines were normal, with the exception of a small area of congestion in the large colon. The mesenteric artery was diseased, and contained *strongyli armati*. The spleen, kidneys, liver and bladder were apparently normal.

Cultures were take from the spleen, heart's blood, kidney, lung and liver.

Cultures from the spleen and heart's blood gave *B. equisepticus* in pure culture. Streptococcus in pure culture was obtained from the kidney. There was no growth in cultures from the lung and liver.

Experiment Horse No. 14.—An old roan mare in good flesh. Weight about 1,100 pounds. Had the "heaves."

April 4, 1903, the blood examination was as follows:

Hæmoglobin (Tallquist), 100 per cent; red cells, 6,632,000; leucocytes, 5,000.

At 11 a. m. on this date the animal was inoculated intravenously into the jugular vein, with 5 c. c. of a 24-hour broth culture of *B. equisepticus* obtained from Rabbit No. 741 (ninth passage through animals from Case No. 34).

At 12 M., the temperature was 101° F., respirations were labored and rapid, aside from this no other symptoms were noted. About 3:10 p. m. the temperature had reached 104.2° F., respirations 56, and the horse was sweating. The highest temperature noted was 105.5, at 4 p. m. The following day the animal appeared entirely recovered, except that it did not eat well. Temperature at 10 a. m. was 102.4° F., and at 4:30 p. m. was 101.8° F. On the third day, at 10 a. m., the temperature was 101° F., and the animal appeared to be fully recovered.

April 9, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 100 per cent; red cells, 7,084,000; leucocytes, 15,000.

At 10 a. m. on this date, the animal was again inoculated intravenously into the jugular vein with 5 c.c. of a 24-hour broth culture of *B. equisepticus* from Rabbit No. 741 (ninth passage through animals from Case No. 34).

At 11:30 a. m., there was diarrhoea, polyuria, the respirations were rapid and labored, and the animal was sweating profusely. Temperature was 102° F. At 1 p. m. the animal appeared to be in the same condition, but the temperature had reached 103.8° F. At 2 p. m. the animal was found dead.

Autopsy was held at 4 p. m. Autopsy notes were as follows:

The lungs were slightly congested in their anterior lobes. The heart was very large and distended with dark bloody fluid. The heart weighed 14 pounds. One small hemorrhage was found on the peritoneal surface of the diaphragm. The liver was very large, and weighed 24 pounds, but appeared to be normal, as was also the spleen and kidney. The large mesenteric artery was much thickened, and contained a few *strongyli armati*, but no clots.

Cultures from the spleen gave *B. equisepticus*. Cultures from the lung and liver showed a diplococcus (?). Cultures from the kidney and heart showed no growth.

Experiment Horse No. 5.—White mare, weight about 900 pounds. This animal was very old and weak, and had not been worked for some time.

Jan. 2, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 90 to 100 per cent; red cells, 7,916,000; leucocytes, 12,000.

At 12 m. on this date the animal was inoculated intravenously into the jugular vein with 285 c. c. of a 24-hour broth culture of *B. equisepticus* from Rabbit No. 640 (third passage through animals from Case No. 34). By 12:30 p. m. the respirations were rapid and labored. A diarrhoea had developed, and the temperature was 100.4° F. At 2:45 p. m. the animal was down and could not be made to get up. The respirations continued rapid, and the animal appeared to be in some pain. At 3 p. m. the temperature had fallen to 99° F., respirations were shallow, 60 to the minute, pulse could not be felt. Animal was found dead at 3:20 p. m.

Autopsy at 5 p. m. Autopsy notes: This horse died in three hours and twenty minutes after inoculation, consequently there were no marked lesions. About the right jugular vein, at the site of inoculation, was found considerable bloody exudate, probably due to wounding the vein at the time of inoculation. Small hemorrhages, varying in size from a pin head to the size of a pea, were found scattered over the surface of both lungs. Upon section of the lungs, small hemorrhages were found, some being as large as one-half inch in diameter. The mesenteric arteries were diseased from the effects of *strongylus tetracanthus.* The other organs were apparently normal. Cultures were taken from the jugular blood, the lung, spleen, kidney and liver. Cultures from the spleen and lung, gave *B. equisepticus* in pure culture. No growth was obtained from the cultures taken from the jugular blood, kidney and liver.

Summary—

1. Large doses of the organism (285 c. c. of a 24-hour broth culture produced death in three hours and twenty minutes after intravenous injection, with symptoms of prostration and collapse. (See Experimental Horse No. 5.)

2. Small doses, i. e., 5 to 10 c. c. produced rise of temperature, polyuria, slight uneasiness and a labored respiration and rapid pulse. When repeated in several days, similar symptoms were evoked, but in Experimental Horse No. 14 death resulted in four hours after the second inoculation.

3. Repeated doses led to emaciation, synovitis and abscess production, and would have been followed by death, were it not for the fact that life was prolonged, and the animals made more comfortable by suspension in slings, and giving them opportunity to secure food and drink in the easiest way.

4. At autopsy, the findings were practically those met with in clinical cases of acute swamp fever.

5. The production of anæmia, and the other hæmal changes which occur in swamp fever had not yet been reproduced in these investigations when it was necessary to bring them to a close.

Pathogenesis of B. Pyrogenes Equinus.—Attention was concentrated largely on the pathogenic properties of *B. equisepticus* and for *B. pyrogenes equinus*, rabbits and horses were practically the only animals employed for inoculation.

Rabbits.—One c. c. of a 24-hour broth culture of *B. pyrogenes equinus* causes death in rabbits in from one to eight days, without producing any marked symptoms. At autopsy, hemorrhages varying in size from petechiæ to half an inch in diameter were found in nearly every instance upon the serous surfaces, in the heart muscle and occasionally in the lungs. No other gross lesions were found. The micro-organism was recovered in pure culture from the blood, fluids and tissues, which evidenced the septicæmic nature of the infection produced.

Horses.—A number of horses were inoculated intravenously with broth cultures of this micro-organism. The strains employed for inoculation were derived from swamp fever Cases Nos. 11 and 12. The results of the experiments are shown in the following detailed reports of inoculations.

Experiment Horse No. 9.—An old, weak black mare, in very poor condition. Weight about 800 pounds. Jan. 12, 1903, the blood examination was as follows:

Hæmoglobin (Tallquist), 90 to 100 per cent; red cells, 10,544,000; leucocytes, 6,000.

This animal was inoculated intravenously into the jugular vein at 11:45 a. m. on this date, with 10 c. c. of a 24-hour broth culture of *B. pyrogenes equinus*, obtained from the heart's blood of Experiment Horse No. 6 (second passage through animals), having been obtained originally from "swamp fever" Case No. 12. At 3:30 p. m. the animal had polyuria, but no other symptoms were noticed, except a gradual rise in temperature, which reached 105.3° F. as its highest at 5:30 p. m. The following morning the animal appeared entirely well, although the temperature was 102.8° F., at 9:15 a. m., but had receded to 100.8° F. at 4:30 p. m.

Jan. 19, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 90 to 100; red cells, 8,040,000; leucocytes, 15,000.

On Jan. 30, 1903, at 10:45 a. m., the animal was given a second intravenous inoculation of 10 c. c. of a 24-hour broth culture of *B. pyrogenes equinus*, obtained from the jugular blood of swamp fever Case No. 12. This produced no symptoms, except a marked polyuria and hyperpyrexia, which continued for ten days, or until the next inoculation. The temperature reached 107.4° F. the next day, and did not go below 102.6° F. the first three days following the inoculation.

Feb. 9, 1903, at 11 a. m. the animal was again inoculated intravenously with 20 c. c. of a 24-hour broth culture of *B. pyrogenes equinus*, obtained from the jugular blood of swamp fever Case No. 12. At 12 M. the animal was down, and the temperature reached 103° F., the highest point for the day. At 2 p. m., there were slight rigors followed by sweating. Next day the animal was up and appeared better. From this time on the animal began to lose flesh, accompanied by gradually increasing weakness, so that it had to be raised in a sling from time to time. The temperature ranged from 99.8 to 104.2° F., although no further inoculations were made. The appetite remained good.

Feb 12, 1903, the right hock was swollen, sensitive and gave fluctuation. The animal was unable to stand on the leg.

Feb. 16, 1903, when the animal was raised in the sling, it having been down for the greater part of the time on the two previous days, it was noticed that there was an abscess on the right ear, another about two by three inches on the right side, about the middle of the seventh rib, and there was a large œdematous area about five by eight inches under the belly.

Feb. 18, 1903, cultures were taken from the œdematous patch under the belly, from the abscess on the side, and from the right hock. Cultures from the abscess and the œdema under the belly gave *B. pyrogenes equinus* unmixed with other organisms. The cultures from the right hock gave no growth.

Blood examination on this date was:

Hæmoglobin (Tallquist), 90 to 100; red cells, 6,444,000; leucocytes, 14,000.

Feb. 21, 1903, the animal was so weak it was thought best not to keep her longer, and she was killed by bleeding, and an autopsy made at once.

Autopsy notes are as follows:

All the subcutaneous fat was of a peculiar yellowish color, almost orange. There was one large hemorrhage, one by two inches, in the subcutaneous tissue of the abdomen. There was an abscess on the right ear which discharged yellow pus several days before death. This was probably due to an injury received when the horse was down the first time. On the right side, about the middle of the seventh rib, was an abscess, two by three inches in diameter, filled with yellow pus. When cultures were taken from this abscess three days before death, there seemed to be no pus in the abscess, but a clear serum. The œdema under the belly had disappeared at the time of death. The right hock joint was enlarged, and filled with clear serum. Culture taken in a pipette from this joint two days before death, gave no growth. At the time of death all the tissues around this joint were very much thickened. It contained a small amount of straw-colored fluid and a few points of organized tissue, somewhat blood-stained.

Upon opening the thorax all the fat about the internal organs was the same dark yellow color as that in the subcutaneous tissues. The lungs contained many petechial hemorrhages on the surface and a few areas of collapse. Upon section they appeared to be quite solid and contained many areas of hemorrhage. The connective tissue appeared somewhat increased in amount and was yellowish in color. The pericardium contained a small amount of straw-colored fluid. There was one large hemorrhage about one inch in diameter upon the pericardium. The heart appeared normal, excepting a few hemorrhages upon the endocardium. The heart weighed five and three-fourth pounds. There were a few hemorrhages upon the diaphragm. The liver seemed normal. Spleen weighed three pounds and was apparently normal, with the exception of numerous petechial hemorrhages into the capsule. The kidneys were apparently normal, with the exception of a thick, gelatinous substance in the hilum. This gelatinous substance was the same peculiar yellow color as that in other parts of the body.

The abdominal aorta at its point of division into the iliacs was entirely occluded with an old organized clot for about two and one-half inches. The inferior vena cava at this point was also occluded with an old clot. The small vessels about the groin and also about the hock were filled with what appeared to be more recent clots.

Cultures were taken from the heart's blood, lung, liver, kidney and spleen.

From the heart's blood there was obtained a large, evenly staining, non-motile bacillus, which formed a heavy wrinkled pellicle in broth, the lower part of the broth remaining clear. It formed a heavy, white, wrinkled spreading growth on all solid media, and undoubtedly was a contamination.

B. pyrogenes equinus was also obtained from heart's blood.

From the lung there was obtained the same large bacillus as was found in the heart's blood, and *B. pyrogenes equinus*.

From the liver, kidney and spleen *B. pyrogenes equinus* was obtained in pure culture.

Experiment Horse No. 10.—A large brown gelding, weight about 1,300 pounds. This animal was in good condition, but was foundered, and was so lame in both front feet that he moved with difficulty, and lay down in the stall a large part of the time.

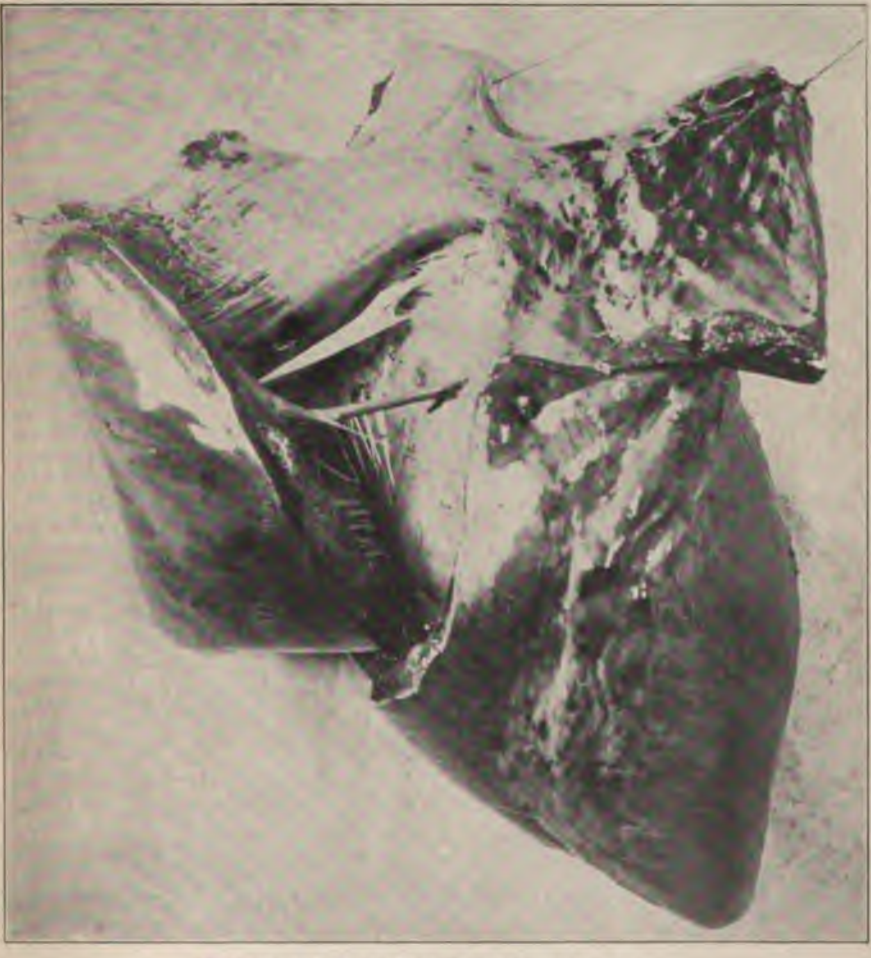
Jan. 20, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 100; red cells, 6,432,000; leucocytes, 11,000.

The horse seemed to suffer so much pain in his front feet that on Jan. 22, 1903, a portion of the median nerve of the right front leg, and a portion of the plantar nerve of the left front leg was excised by Drs. Brimhall and Annand. The next day there was considerable swelling and tenderness in both front legs. Later the hoofs of both front feet became loosened, and discharged blood and serum. This condition probably accounts for the high temperature from this time on.

In order to determine whether or not the introduction into the circulation of large quantities of plain broth would produce any symptoms, this horse was inoculated Jan. 26, 1903, at 10 a. m., intravenously into the jugular vein with 300 c. c. of plain broth. No symptoms or elevation of temperature were noticed.

Jan. 30, 1903, at 10:15 a. m. the animal was inoculated intravenously into the jugular vein with 275 c. c. of a 24-hour broth culture of *B. pyrogenes equinus*, obtained from the jugular blood of swamp fever Case No. 12. At 11 a. m. the horse went down, and there was labored, rapid respiration and considerable uneasiness. The animal remained in this condition during the afternoon, the temperature gradually falling to 98.6° F. at 5 p. m., the last time it was taken. The horse was found dead the next morning.



HEART OF EXPERIMENTAL HORSE NO. 10.

The hemorrhages are easily seen both under the epicardium and endocardium.
(See autopsy notes, page 365.)

The autopsy notes are as follows:

Some peculiar areas of yellow œdema were found in the fascia of the latissimus dorsi muscle. There were several large hemorrhages about the borders of the lungs, especially anterior borders and several large air bullæ. Some of these bullæ contained blood. Upon the pericardium was a large mass of this peculiar yellow gelatinous substance also stained with blood. The heart muscle contained many hemorrhages upon its external and internal surfaces. (See cut opposite page 364.) The interior of the left ventricle was nearly a solid mass of blood, some being in the coronary vessels, but most of it in the muscular tissue. The liver was very much congested, but otherwise appeared normal. The spleen was large and mottled over its entire surface with hemorrhages. (See cut opposite page 366.) About both kidneys were large masses of this thick, yellowish œdema. The right adrenal body was markedly hemorrhagic. The kidneys themselves, were slightly congested, but not hemorrhagic. The mesenteric artery for about three inches after leaving the abdominal aorta was thickened and tortuous. This near the surface was very much roughened and contained many small worms (*strongylus armatus*).

Cultures were made from the heart's blood, kidney, lung, spleen and liver.

Cultures from the heart's blood showed a yellow staphylococcus and *B. pyrogenes equinus.*

Cultures from the kidney showed streptococcus and *B. pyrogenes equinus.*

Cultures from the lung, spleen and liver showed *B. pyrogenes equinus* in pure culture.

Experiment Horse No. 11.—An old, thin black mare, in poor condition, weight about 850 pounds.

Jan. 20, 1903, blood examination was as follows:

Hæmoglobin (Tallquist), 100; red cells, 6,288,000; leucocytes, 14,000.

Blood examination, Jan. 23, 1903, was as follows:

Hæmoglobin (Tallquist), 100; red cells, 6,560,000; leucocytes, 18,000.

Jan. 23, 1903, at 11:30 a. m., this horse was inoculated intravenously into the jugular vein with 270 c. c. of *B. pyrogenes equinus* obtained from the jugular blood of swamp fever Case No. 12.

At the time of inoculation the precaution of filling the rubber tubing leading from the flask to the needle was not taken, so that it was known that several c. c. of air entered directly into the jugular vein. The horse died at 4:30 p. m., same date. Autopsy held at once. Autopsy notes are as follows:

The lungs contained several air vesicles. They dented easily and crepitation was more marked than common. They contained many hard, small dark nodules, such as Dr. Brimhall had seen in old glanders cases.

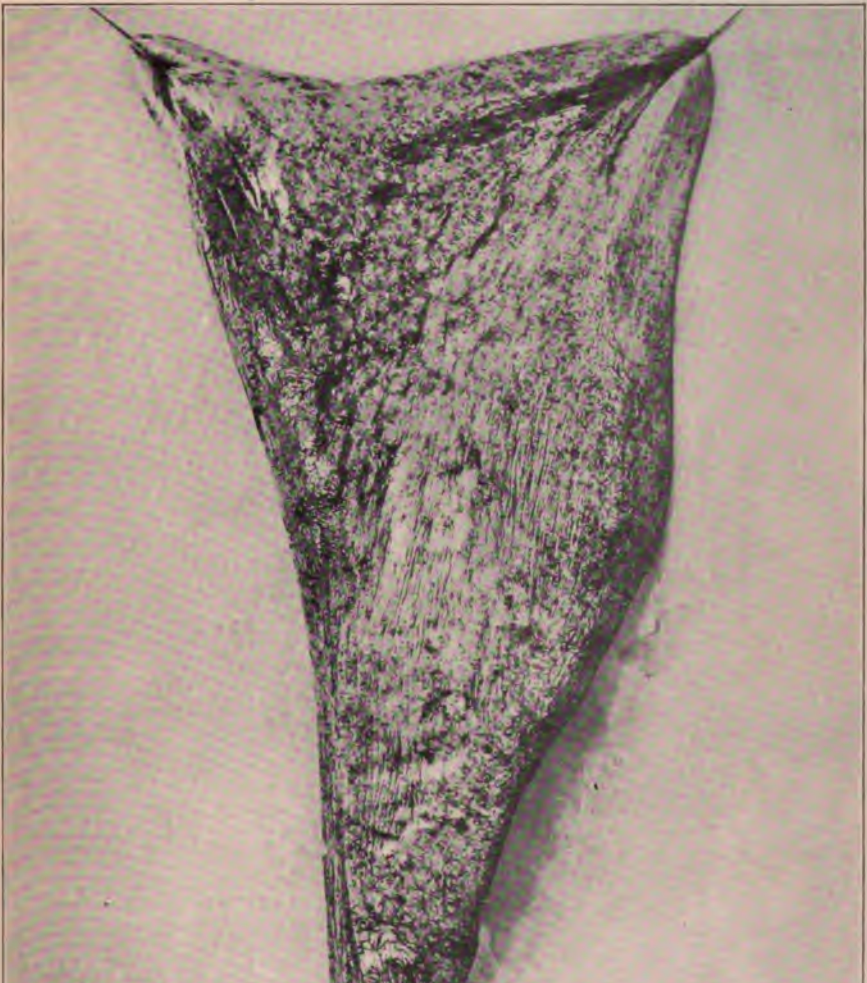
The right side of the heart contained a large chicken-fat clot; also frothy blood. The left side contained dark fluid blood, but no air bubbles. Upon sectioning the heart muscle, frothy blood oozed from the small vessels. The endocardium showed many small hemorrhages. The spleen appeared to be normal. The liver was apparently normal, but upon section bloody froth oozed from the cut surface. The right kidney contained a large cyst in its cortex, about three inches in diameter. This was filled with a clear, straw-colored fluid. Several smaller cysts were found through the cortex, and several cysts were also found in the left kidney. The mesenteric artery immediately after leaving the abdominal aorta was thickened, tortuous and contained many small worms (*strongylus tetracanthus*).

Cultures were taken from the lung, heart's blood, liver, spleen and kidney. From the lung, *B. subtilis* was obtained. From the heart's blood, a white staphylococcus, and from the liver, spleen and kidney, colon bacillus.

Experiment Horse No. 8.—An old, weak brown mare, weight about 1,000 pounds. This animal was inoculated intravenously into the jugular vein at 12:05 p. m., Jan. 12, 1903, with 230 c. c. of a 24-hour broth culture of *B. pyrogenes equinus*, obtained from the jugular blood of swamp fever Case No. 12. The animal went down while being inoculated, and died in 10 minutes. It would seem therefore, that the animal's heart was not able to stand the extra strain placed upon it by the sudden introduction of such a large quantity of fluid directly into the circulation, or that it died from an embolism caused by a small particle of some kind in the broth. It will be remembered that this organism forms a heavy sediment when grown in broth. The following blood examination made immediately before the inoculation shows that the animal was not in good health:

Hæmoglobin (Tallquist), 90; red cells, 8,628,000; leucocytes, 41,000.

No autopsy was made.



SPLEEN OF EXPERIMENTAL HORSE NO. 10,

which succumbed in less than twenty-four hours after an intravenous inoculation (275 c. c.) of a twenty-four hour broth culture of *B. pyrogenes equinus*. The hemorrhages appear as dark spots in the photograph and are very numerous. (See autopsy notes, page 365.)

Summary—

1. Large doses of *B. pyrogenes equinus* (275 c. c. fresh broth culture), when given intravenously, produced the death of the animal in less than 20 hours. Immediately following the inoculation, labored rapid respiration, considerable uneasiness, with initial rise of temperature were exhibited, the animal being unable to stand. (Experiment Horses Nos. 10 and 11.)

2. Repeated small doses (10 to 20 c. c.), see Experiment Horse No. 9, produced marked hyperpyrexia, polyuria, synovitis, œdema on the belly and progressive weakness, so that the animal was killed about six weeks after inoculation. The red blood cell count was decreased, the leucocytes increased, and the hæmoglobin remained the same.

3. At autopsy following large doses, very marked hemorrhagic lesions, and yellowish gelatinous œdema were seen.

4. Animals inoculated with repeated small doses showed at autopsy superficial abscesses. Hemorrhages and thick gelatinous œdema were found in the internal organs.

Demonstration of the Difficulty of Recognizing and Isolating B. Equisepticus When Mixed With B. Pyrogenes Equinus—Pathogenesis for Horses of the Mixture of the Two Organisms.

Experiment Horse No. 6 was an old, weak black horse, in poor condition. Weight about 900 pounds.

The blood examination on Jan. 2, 1903, immediately before inoculation was as follows:

Hæmoglobin (Tallquist), 80 to 100; red cells, 3,476,000; leucocytes, 7,000.

The animal was inoculated intravenously at 11:45 a. m. on this date, with 265 c. c. of a 24-hour broth culture of what was thought to be pure *B. pyrogenes equinus,* obtained from the spleen of Rabbit No. 588 (first passage through animals from Case 11).

At 3 p. m., the horse had slight rigors, and its hind legs were trembling. The respiration was rapid and labored. By 3:20 p. m. the animal was down and could not be made to get up. At 3:45 p. m. the horse was standing up and appeared better. The temperature reached the highest point at 6:30 p. m., when it was 104.8° F.

The following day the animal appeared much improved, although the temperature remained above 103°. On the second day the horse seemed to be in about the same condition, although the temperature reached 104.4° F. at 11 a. m.

On the morning of January 5th, the third day after inoculation, the horse was found dead.

Autopsy Notes.—Under the skin on the side which was uppermost at the time of death, many hemorrhagic lesions, about one-half inch to one inch in diameter were found in the area over the ribs. The lungs contained many small hemorrhages about the size of peas. A small hemorrhagic area was noticed on the lower portion of the pericardium. The heart muscle contained several hemorrhages one-half to one inch in diameter. The spleen was small and apparently normal, weight three pounds. The liver was apparently normal, weight 14 pounds. The ductus venosus was large, and not entirely closed. There was a thick mass of connective tissue and fat over the bile duct. The stomach and intestines contained several large hemorrhages. The intestines at the point of the hemorrhages looked as if ulcerated and about to perforate. The mesenteric glands were hemorrhagic and enlarged. Attached to the peritoneum on the mesentery, there was a tumor about two inches long and one inch thick, covered with a hard fibrous capsule containing a calcareous deposit. The mesenteric artery contained several aneurisms; also organized clots and worms (*strongylus tetracanthus*). The right ischium was fractured, probably due to struggles in the stall or falling on the cement floor.

Bacteriological Findings.—Cultures were made from the liver, kidney, spleen, lung and heart's blood.

B. pyrogenes equinus was obtained in pure culture from the liver, kidney and spleen.

B. pyrogenes equinus, mixed with *B. equisepticus*, was obtained from the lung and heart's blood.

This case is particularly instructive, from the fact that a supposedly pure organism, *B. pyrogenes equinus* was grown upon various media and passed through two animals, and yet later found to be mixed with *B. equisepticus*, and this, by workers who were familiar with the members of the hemorrhagic septicæmia group.

Rabbit No. 588, from which the culture for inoculating Horse No. 6 was obtained, was inoculated with a culture of *B. pyrogenes equinus* (supposedly pure), obtained from the spleen of swamp fever Case No. 11. At the autopsy of the rabbit, the same organism was recovered in seemingly pure culture. This culture was placed in the culture closet Nov. 18, 1902, and kept at a temperature of about 20° C., until Jan. 1, 1903 (44 days), when sowings were made to obtain a fresh culture for inoculating Experiment Horse No. 6. This horse was inoculated Jan. 2, 1903, and died three days later (Jan. 5, 1903). From the cultures taken at the autopsy of the horse, *B. pyrogenes equinus* was recovered, but mixed with *B. equisepticus*.

On obtaining these results, the supposedly pure culture of *B. pyrogenes equinus*, obtained from the rabbit mentioned above (No. 588), and used for inoculating Experiment Horse No. 6, was carefully examined, and found to contain *B. equisepticus* also. Therefore, it would seem that the two organisms had been mixed in the original and apparently pure cultures of *B. pyrogenes equinus* obtained from swamp fever Case 11, and had been passed through Rabbit 588, recovered at autopsy, and inoculated into Experiment Horse No. 6, the presence of *B. equisepticus* being unnoticed even by those familiar with it.

As mentioned above, the case illustrates the *extreme* difficulty encountered in recognizing and isolating the members of the hemorrhagic septicæmia group, especially when they are mixed with other bacteria, which resemble them in morphology, or grow abundantly on ordinary media.

Toxine Experiments.—*B. equisepticus.*—In order to determine whether this organism produced a soluble toxine or not, the following experiments were conducted:

A small flask of plain broth was inoculated with *B. equisepticus* obtained from Rabbit 708 (seventh passage through animals), and incubated for 24 hours. Rabbit No. 714, weight 710 grammes, was inoculated intravenously with 0.5 c. c. of this culture. It died in less than 16 hours, and the organism was recovered in pure culture from the heart's blood and liver. The flask was then incubated for 5 days, when Rabbit No. 717, weight 1,140 grammes, was inoculated intravenously with 1.0 c. c. of the culture. This animal also died in less than 16 hours, and the organism was obtained in pure culture from its heart's blood and liver.

This five-day culture was then divided into two parts. Part No. 1 was filtered through a sterile Pasteur filter, and the filtrate collected in a sterile glass bulb. Cultures were made into broth, and upon agar from the filtrate, and placed in the incubator. At the end of 48 hours there was no growth. When it was found that no bacteria had passed through the filter, Rabbit No. 719, weight 940 grammes, was inoculated intravenously with 5 c. c. of the filtrate. The rabbit showed no symptoms, and was used again 78 days after.

Part 2 was shaken up with an excess of chloroform and placed in the ice chest for 24 hours. The flask was then placed in a water bath, heated to 45° C. under reduced pressure, and the chloroform vapor drawn off with a water pump. When the odor of chloroform could no longer be detected, cultures were made and incubated 48 hours. No growth appeared. Rabbit No. 728, weight 1,150 grammes, was then inoculated intravenously with 1 c. c. of this killed culture. The rabbit showed no symptoms, and was used again 27 days later.

Another flask of broth was inoculated with *B. equisepticus*, obtained from Rabbit No. 718 (eighth passage through animals), and placed in the incubator. When the culture was 24 hours old, Rabbit No. 724, weight 585 grammes, was inoculated intravenously with 0.2 c. c. It died in less than 16 hours, and *B. equisepticus* was obtained from its heart blood and liver in pure culture. The culture was then incubated until 48 hours old, when it was divided into two parts.

Part 1 was filtered through a sterile Pasteur filter—cultures were made from the filtrate and incubated for 48 hours, but showed no growth. Rabbit No. 736 (weight 1,850 grammes), was inoculated intravenously with 5 c. c. of this filtrate, but showed no symptoms, and was used again 20 days later.

Part 2 was shaken up with an excess of chloroform and placed in the ice chest for 24 hours, then heated to 45° C. in a water bath under reduced pressure, and the chloroform vapor drawn off with a water pump. When the odor of chloroform could no longer be detected, cultures were made from the remaining broth and incubated for 48 hours. No growth appeared. Rabbit No. 738 (weight 2,250 grammes) was inoculated intravenously with 2 c. c., and Rabbit No. 737 (weight 2,000 grammes) in the same manner with 5 c. c. of this killed culture. Neither rabbit showed any symptoms, and they were used again 15 days later.

Conclusions.—It will be seen from the above experiments that while 0.2 c. c. and 0.5 c. c. of a 24-hour broth culture, and 1 c. c. of a 5-day broth culture of the organism, killed rabbits in less than 16 hours, when they were inoculated in the same manner with 5 c. c. (5 to 25 times as much) of the filtrate, or cultures killed with chloroform, no symptoms developed.

Reference to Table IV. will show that a dose of 0,0000000.1 c. c. of a fresh broth culture of *B. equisepticus* of this same strain was sufficient to produce lethal results.

B. pyrogenes equinus.—These experiments were begun to determine whether or not *B. pyrogenes equinus* forms a soluble toxine, but on account of the pressure of other work the experiments had to be abandoned before any definite conclusions could be obtained. Rabbit No. 696 was inoculated intravenously with 1 c. c. of a 24-hour broth culture of *B. pyrogenes equinus*, obtained from the spleen of Experiment Horse No. 9. The animal showed no symptoms, and is alive and well at the present time (four months after inoculation). Another rabbit, No. 726, was inoculated intravenously with 1 c. c. of a 24-hour broth culture of *B. pyrogenes equinus*, obtained from the same source as that used for the above rabbit. This animal died within 24 hours, and *B. pyrogenes equinus* was regained at autopsy, in pure culture.

A small flask of broth was inoculated with the same strain of *B. pyrogenes equinus*, used for inoculating the two rabbits mentioned above. When the culture was 48 hours old it was filtered through a sterile Pasteur filter, and the filtrate collected in a sterile glass bulb. Cultures were made from the filtrate and incubated for 48 hours. No growth appeared. When it was found that no bacteria had passed through the filter, Rabbit No. 693 was inoculated intravenously with 1 c. c. of the filtrate, and Rabbit No. 94 was inoculated in the same manner with 5 c. c. of the filtrate. Rabbit No. 693 showed no symptoms, and was used again 49 days later. Rabbit No. 694 was found dead two days later. No bacteria developed in the cultures taken at autopsy.

It will be seen from the above that two rabbits were inoculated with 1 c. c. each of a 24-hour broth culture of *B. pyrogenes equinus;* one of them died in less than 24 hours, and the organism was recovered at autopsy, while the other one showed no symptoms during the four months it was kept under observation.

Two rabbits were inoculated with the sterile filtrate, the one inoculated with 1 c. c. showed no symptoms during the 49 days it was under observation, while the one inoculated with 5 c. c. of the filtrate died in 48 hours, and no bacteria were found in the cultures taken at autopsy.

Conclusion.—From the above experiment it would appear that *B. pyrogenes equinus* forms a soluble toxine capable of producing death in rabbits if given in a sufficiently large dose; but since the work could not be carried on at present or the results confirmed or disproved by further experiments, no definite opinion can be expressed at this time.

Prophylaxis.—Experiments extending over a period of more than two months have been in progress to ascertain the possibility of producing an antitoxic serum by the inoculation of killed cultures of *B. equisepticus.*

Experiment horse No. 13 and a series of six rabbits have been repeatedly inoculated with broth cultures of *B. equisepticus*, which had been killed by heat. Five hours after each injection (intravenous) into the horse, the temperature of the animal was elevated 5 or 6° Fahrenheit, although it dropped to normal on the following day. No other symptoms were noted.

The incompleteness of this line of investigation precludes the possibility of making any more definite statements at this time, although it is hoped that further report on this phase of the question may be made at a later date, when the work now in progress is completed.

SUMMARY.

1. A disease popularly called "swamp fever," usually chronic in nature and characterized by insidious onset, loss of condition, irregularly periodic fever, progressive emaciation and anæmia, unimpaired or voracious appetite, development of "staggering" gait, and in many cases polyuria, has been found to exist in two foci in Minnesota.

2. Little has been found which tends to show the means by which it is spread. Insufficient evidence has been secured to justify the popular name.

3. The disease is usually fatal, the mortality being about 80 per cent.

4. Reports of the loss on 26 farms of 136 horses within two to seven years, in an area about two miles wide by six miles long, near Beltrami, justifies the suspicion that other localities in the same district, if carefully investigated, might reveal a similar condition of affairs.

5. In the 18 outbreaks here reported, 21 autopsies have been held. From the tissues, blood and fluids, a micro-organism, belonging to the hemorrhagic septicæmia group and described in this report as *B. equisepticus*, has been demonstrated positively in 17, and probably in two others, i. e., in 19 out of the 21 autopsies. Widespread contamination of the cultures made in one of the two remaining cases, and the fact that the last case was one of recovery, probably account for failure to demonstrate *B. equisepticus* in them.

6. *B. equisepticus* is the most virulent micro-organism for rabbits ever studied in this laboratory. For horses it is also virulent. The symptoms and pathological lesions of the disease were fairly well reproduced by experimental inoculation of horses, with recovery from the fluids and tissues of *B. equisepticus* in pure culture.

7. An etiological relationship between *B. equisepticus* and the disease "swamp fever" would therefore seem to be a safe deduction from the autopsy findings in clinical cases and the experimental inoculations.

8. The demonstration of another micro-organism, here described as *B. pyrogenes equinus* in six cases of "swamp fever," but limited to two farms, does not permit of its consideration at this time as an etiological factor in this disease, although it has never been met with in any of the investigations of this board, except in these six cases of "swamp fever," and although in experimental inoculation symptoms and lesions were produced, which are comparable to those of "swamp fever."

9. Relative to the distribution of this disease outside of Minnesota little can be said. In Manitoba a disease known as "swamp fever," and resembling that met with in Minnesota, has not yet been shown to be etiologically identical. "Bottom disease" in the valley of the Missouri should be thoroughly investigated, and the presence or absence of *B. equisepticus* determined.

Lignières has somewhat vaguely described the occurrence of a group of diseases, "Pasteurellose equine" occurring in Europe and South America as due to "bacilles ovoides" (*B. equisepticus ?*), but whether "swamp fever," as observed in Minnesota, has ever been seen by Lignières cannot be determined from his description.

10. The pathology of "swamp fever" would seem to be a septicæmia, accompanied by great destruction of red blood cells, inflammations and hemorrhages of serous membranes and degenerations and hemorrhages in glands and tissues, whilst pus formation is frequent. Certain findings would seem to point to the alimentary tract as the *atrium* of infection, but much remains to be worked out before positive statements can be made.

11. Protective and curative measures have not yet been formulated, owing to the impossibility of concluding investigations now under way, in time to be included in this report.

12. A later report will be made when the pathological material now on hand has been worked up and the experimental investigations dealing with means of transmission of the disease and curative or preventive treatment based on laboratory methods have been completed.

13. The investigations here reported illustrate the very great necessity of the fullest collaboration in field and experimental work between veterinary and laboratory observers in the study of

an unknown disease. At times it is desirable to be able to concentrate a whole laboratory staff on such problems.

* * * * * * * * * *

This board wishes to express its appreciation of the spirit of collaboration exhibited by Drs. Gordon Bell and Frederick Torrance, of Winnipeg, as well as by other Canadian investigators. Through them this board was afforded an opportunity of studying cases of "Swamp Fever" in Manitoba, and but for an unforeseen accident a more accurate comparison of the etiology of the disease in Manitoba and Minnesota would have been possible. The very careful study of the disease by Drs. Torrance and Bell afforded practically the only information available in America, and their work has aroused an interest which should not be allowed to abate until all phases at present in obscurity are cleared up.

NOTE.—Since this report was placed in the hands of the printer, an article on "Equine Malaria and Its Sequelae," by A. Theiler, Bacteriologist to the Transvaal Government, has appeared in the June 30, Vol. XVI., No. —, Journal of Comparative Pathology and Therapeutics, page 97 et seq.

The South African disease described in this article is due to a parasite, the "*pyroplasma equi.*" The author believes that invasion by this parasite predisposes to a symbiotic and secondary infection by a specific bacillus, which from his description would appear to have certain points of resemblance both to *bacillus equisepticus* and to *bacillus pyrogenes equinus*, but not to be identical with either.

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